Darwin Initiative Main Project Annual Report

Important note: *To be completed with reference to the Reporting Guidance Notes for Project Leaders: it is expected that this report will be no more than 10 pages in length, excluding annexes*

Submission Deadline: 30 April

Darwin Project Information

Project Reference	21-005
Project Title	Pesticide plants for organic cotton, livelihoods and biodiversity in Mali
Host Country/ies	Mali
Contract Holder Institution	Royal Botanic Gardens, Kew
Partner institutions	Institut d'Economie Rurale (IER Mali); Mouvement Biologique Malien – MOBIOM (Mali) ; Natural Resources Institute, University of Greenwich (UK)
Darwin Grant Value	£258,540
Funder (DFID/Defra)	DFID
Start/end dates of project	01/04/2014-31/03/2017
Reporting period (e.g., Apr 2015 – Mar 2016) and number (e.g., Annual Report 1, 2, 3)	April 2015-March 2016, Y2/Annual Report 2
Project Leader name	Dr. Paul Wilkin
Project website/blog/Twitter	http://www.kew.org/science-conservation/research-data/science-directory/projects/pesticide-plants-organic-cotton-mali, https://www.facebook.com/darwinmalicotton/, https://twitter.com/eligmocarpus/status/745927354548166658
Report author(s) and date	Dr. Paul Wilkin (Kew), Mr. Stéphane Rivière (Kew), Dr. Paul Green (Kew), Dr. Sidi Sanogo (IER), Mr. Kader Sanogo (IER) – June 2016

1. Project Rationale

Mali is a Least Developed Country facing increasing pressure on its natural resources and biodiversity. In the regions of Sikasso, Segou, Kayes and Koulikoro, communities rely on cotton as one of the important cash-crops. However, Mali's 4th CBD Progress Report highlighted that increased cotton cultivation is threatening ecosystems because of the harmful chemical pesticides used and the depletion of forest cover.

At the point of project design, it was clear that the growing organic cotton market provided an opportunity for farmers in Mali to double their income in comparison to the sale of conventional cotton, while reducing their impact on the environment. However, production of organic cotton relied on unsustainable wild harvesting of naturally pesticide plants to replace chemical pesticides.

A number of pesticide-producing plant species were in decline, threatening the long term viability of organic cotton production. Kew led consultations with farmers which showed that there was a “trial and error” approach to using native pesticide plants, with a limited understanding of the volume or dilutions needed to protect crops. This caused waste and affected the reliability and efficacy of these natural pesticides. There was also no knowledge of how to collect, conserve, germinate and propagate seeds from these species to ensure sustainable supplies. If these issues were not addressed, wild plant populations would diminish or even become extinct, threatening livelihoods, the resilience of communities and biodiversity.

This project aimed to increase the income of target communities in Mali and reduce the depletion of plant biodiversity by providing the scientific expertise needed to establish the sustainable use and cultivation of native pesticide plants for organic cotton production.

Activities fall under the following five areas:

1. Identification and authentication of native pesticide species currently used by organic cotton farmers in target communities
2. Active compounds / ingredients in the key pesticide plants being used by cotton producers are identified
3. Four small-scale organic pesticide producers established and trained to supply optimum standard organic pesticides to cotton farmers
4. Four community demonstration gardens established to strengthen the capacity of target communities to cultivate pesticide plants.
5. Increased awareness of pesticide plant use for organic cotton production among policy makers in Mali (CMDT, Compagnie Malienne pour le Développement du Textile, Mali’s National Cotton Board /Department of Agriculture/Department of Forestry).

Project activity is based in four regions of southwestern Mali: Kayes, Koulikoro (surrounding Bamako Capital District), Sikasso and Segou (see map below). IER is based in Sikasso, MOBIOM in Bougouni (indicated)

2. Project Partnerships

The principal partner in Mali is IER, the national agricultural research institution, which hosts Mali's Forestry Research Programme located at the regional centre of Sikasso. It has worked with Kew to study the diversity of and conserve the Malian flora for over 10 years and has the expertise to undertake wild seed collecting, handling and conservation, as well as establishing community gardens. Kew and IER have worked closely together to strengthen the institutional capacity of the authorities in Mali to manage the country's flora. This collaboration has led to an active national seed bank, herbarium and comprehensive database of about 50% of Mali's wild plant species held at IER, and provided the mechanism for the demand in Mali for the project and its outputs to be imparted to RBG, Kew. The lead contact in IER for this project is Dr. Sidi Sanogo who is a seed expert and the national manager of Mali's seed bank. His principal responsibilities are project implementation and coordination, reporting, project management and community participatory M & E.

The partnership between Kew and IER has undergone considerable change in Y2 of the project, principally through the former PI, Dr. Moctar Sacande leaving the organisation in October 2015 with just the standard notice period as warning. Serene Hargreaves, who had worked with partners in West Africa (see Y1 report) also left the project. Unfortunately, these events were followed by terrorist incidents in Bamako and Ougadougou that effectively prevented travel to the region to meet key project personnel by the new PI and other Kew staff. Obtaining visas to enable project personnel from Mali to travel to the UK proved a lengthy exercise. Nevertheless, Dr. Sidi Sanogo (Head of the IER Forestry Seeds Herbarium Unit and the Regional Centre for Agricultural Research in Sikasso, Mali) and M. Kader Sanogo (Coordinator of the project "Conservation and sustainable management of Useful Plants to Local Communities" (Useful Plants Project)) were eventually able to visit RBG, Kew from May 30th to June 16th to successfully redefine and reinvigorate the key partnership that underpins the project. The visit also enabled the Kew team to be fully updated on in-country progress and full participation by IER in the production of this report. However, activity in Mali is now wholly under the management of IER with progress then reported to Kew; direct participation has not been possible and is likely to remain so. The issues outlined here come on top of problems with Ebola in Y1.

The project's partnership with Mouvement Biologique Malien (MOBIOM) is managed wholly through IER. It is underpinned by an initial agreement that was established in Y1 and defines the activities that will be carried out every year by each Partner. For this reporting period, MOBIOM has carried out field activities such as surveys for the monitoring of show-case plots, and the animation of the organic cotton farmer's cooperatives. Evidence for these activities is found in an activity report produced by MOBIOM for the reporting period April 2015-April 2016 (Annex A) and in photographs 1 and 2.

The partnership with the Natural Resources Institute (NRI), University of Greenwich was underpinned by Prof. Phil Stevenson's joint appointment at RBG, Kew and that Institute. This remains the case and strengthens his ability to provide scientific evidence underpinning the use of key ecosystem services, such as the validation of plant-based pesticides via bioassays and chemical analysis using the facilities of both organisations.

During the project an additional partnership has been consolidated, between IER and DMT (Département de Médecine Traditionnelle de l'Université de Bamako). DMT have undertaken toxicity tests in pesticide plants and investigated their phytochemical composition in addition to work done by Prof. Stevenson's team. This work is covered in Annex B.

Communication with project partners in Mali has been greatly enhanced by the recruitment of Stéphane Rivière as a project officer at RBG, Kew with responsibility for this and other regional projects from June 2016. Stéphane will take primary responsibility for maintaining contact with Malian partners via skype, email and phone for the remainder of the project.

3. Project Progress

3.1 Progress in carrying out project activities

Output 1: Identification/authentication

Activity 1.1 Survey of pesticide plants. Data entry into the database described in the Y1 report has continued for 25 species. These data describe different types of local preparation pesticide extracts, farmers' dosages and frequency of use of these bio-pesticides in addition to taxonomic and distribution data.

1.2 Collection and identification of pesticide plants. Biopesticide tests, plant production, propagation in laboratory and specimens were collected for 18 species (Annex F). Botanical surveys were carried out by the Forestry program team to observe the seeded plots (Photograph 3).

1*.3 Botanical and biological research on collected specimens*. The Forestry program team conducted germination and conservation of tests on the collected seeds. The seeds of pesticide and food species were harvested for the production of plants (Annex E).

1.4 Data compilation. All available data including those from ethnobotanical surveys are now included in the database. A species profile has been produced for *Carapa procera* (Annex D)

Output 2: Active compounds/ingredients identified, effectiveness of different species established

2.1 Collection for by-product extraction/study of extractions. Collecting of pesticide plant organs continued in villages with the support of facilitators and supervisors. Specimens of collected organs of pesticide plants were packaged in the Laboratory of Entomology. Tests which studied the effectiveness of bio-pesticide products installed in the farm (cotton fields) and which were carried out in August were completed in November 2015. Species and formulation used were as follows:

- Former formulation: seed extracts of *Azadirachta indica* + oil of *Carapa procera*
- New formulation (1): stem extracts of *Euphorbia paganorum* + bark extract of *Khaya senegalensis* + oil of *Carapa procera*
- New formulation (2): plant extract of *Chamaecrista nigricans* + stem extracts of *Euphorbia paganorum* + oil of *Balanites aegyptiaca*

New formulation (1) was proposed to organic cotton farmers before the application of results of the research carried out for the Mali Cotton Project (Darwin and TRAID).

2.2 Bioassays and compound identifications. The six species sent to Kew were evaluated as feeding repellents against cotton bollworm, *Helicoverpa armigera*. They were *Carapa procera*, *Chamaecrista nigricans*, *Khaya senegalensis*, *Securidaca longipedunculata*, *Bobgunnia madagascariensis* and *Balanites aegyptiaca*. Feeding was repelled by *C. nigricans* and stimulated by extracts from the other species. Further research is needed to evaluate the toxic effects of the compounds on the insects in the time period after feeding. *Helicoverpa armigera* supply issues now appear to be resolved and further samples need to be transferred from Mali. Tests on extracts from 23 species occurred in Mali. Five showed high levels of effectiveness against cotton pests.

2.3 Tests in the field leading to standardisation/guidelines. The seed/cotton yields of new formulations (1) and (2) exceeded those of the former formulation: mean 390.6 Kg / ha against 320.3 kg / ha in Yanfolila (New formulation 1); 422 kg / ha against 343.8 kg / ha in Kolondiéba (New formulation 2). Guidelines for use are in Annex C with graphs showing farmer yields in the two communities.

Output 3.Small scale pesticide producers established and trained

3.1 Developing improved techniques for harvesting and preparation of plant organs. Studies of extraction of *Balanites aegyptiaca* and *Zanthoxylum zanthoxyloides* oils for use as adjuvants is being carried out in the Laboratory of Forestry programme (Annex E).

3.2 Training workshops on preparing standardised products. A training session was organised in July 2015 on the oil extraction techniques of *Carapa procera*. Ten women from cooperatives in Bougouni and Yanfolila have benefited from this training. Three nurserymen were trained in harvesting techniques of seeds and plant production techniques in the province of Bla. Further farmers were trained in planting techniques and plot-based pesticide plants and food plants were installed in the farms

In December 2015, training in techniques for extracting oil from pesticide plants: A training session was held on techniques for extracting oil from *Balanites aegyptiaca*. Ten (10) women's cooperatives Mobiom of Bla, Kolondiéba, Kita and Kolokani benefited from this training. The training was followed by an initiation session on the preparation and use of biopesticide products (Photograph 6).

3.3 Develop IPR, farmers' ownership and product registration protocols. This activity was scheduled for Y3, but in Y2 installation and equipment for cooperative supporting oil extraction took place at two women's cooperatives (Ziékorodougou in Sikasso and Samaguéla in Yanfolila) in the form of a press each and packaging materials). During the delivery of equipment, a training session was organised in every village in March 2016: 21 women in Samaguéla; 43 women in Ziékorodougou.

3.4 Develop local industrial investments and markets. This activity was scheduled for Y3.

Output 4. Four community gardens established

*4.1 Generate data on species production methods.*The production of plants is underway in three nurseries in Segou and Sikasso as described in the Y1 report. The species being produced are: *Adansonia digitata, Khaya senegalensis, Tamarindus indica, Ziziphus mauritiana, Carapa procera* and *Parkia biglobosa*. An example of information on propagation methods as well as plant description, phenology, distribution, usage, collection and seed conservation and trade is available in Annex D (*Carapa procera*).

4.2 Train, collect seeds and produce seedlings. Equipment and training of community nursery cultivators:stakeholders from three (3) nurseries in Bla (2 from the village of Niala and 1 village from Kégnésso) were equipped (nursery material and seeds) and trained in harvesting techniques of seed and seedling production in February 2016 (Photographs 7, 8, 9 and 10)

4.3 Planting seedlings and maintaining demonstration plots. In total 11 hectares were planted in both 2014 and 2015 across 19 farms. The species used were *Adansonia digitata, Khaya senegalensis, Carapa procera, Tamarindus indica, Faidherbia albida, Parkia biglobosa* and *Ziziphus mauritiana*. They have been supplied by three nurseries and have produced 19,500 plants of *Adansonia digitata, Khaya senegalensis, Carapa procera, Tamarindus indica, Parkia biglobosa, Ziziphus mauritiana, Faidherbia albida* for the demonstration plots and members of organic cotton producers' cooperatives in the Bla area.

Maintenance, monitoring and protection of demonstration plots: plots of pesticide and food plants set up in 2014 and 2015 were monitored, protected and evaluated. The biophysical evaluation (measurement of height and diameter) was conducted during the month of December 2015. During all the dry season, farmers watered the plants and monitored plots against wandering animals (Annex E).

4.4 Farmer and NGO information workshops. Activity deferred to Y3.

4.5 Promotion via farming fairs, exhibitions (video) and local radio. This activity was scheduled for Y3.

4.6 Reproduction of guide/hand book, leaflets and posters. This activity was scheduled for Y3.

Output 5. Increased awareness of pesticide plant use for organic cotton production among policy makers of Mali.

5.1 Present research findings and organise field visits (CMDT). The 2014 campaign results of the pesticide project were presented to the partner farmer cooperatives. MOBIOM provided a technical report of activities (Annex A, Photograph 14).

Botanical and biological research were conducted at the IER Forestry seed laboratory and the Laboratory of Entomology. The development of vegetative propagation techniques of *Euphorbia paganorum*, *Securidaca longepedunculata* and *Ximenia americana* are underway in the former. In the latter, tests of effectiveness of plant extracts on the cotton pests are underway.

5.2 Organise field visits of woodlots for Dept. of Agriculture. Activity deferred to Y3

5.3 Presentation of project findings to national policy makers. This activity was scheduled for Y3.

3.2 Progress towards project outputs

Output 1:	Identification and authentication of pesticide species currently used by organic cotton farmers in target communities			Comments (if necessary)
	Baseline	Change recorded by 2016	Source of evidence	
Indicator 1.1	No list of pesticide plants at start of project	Base list established from desk study and questionnaires in the 4 regions of Mali	List of 25 species (please see Annex E).	
Indicator 1.2	No specimens of seeds and herbarium vouchers of pesticide plants collected at start of project.	89 voucher specimens and 30 seed accessions collected and stored in Mali. Other seed collections made and used for oil extraction/training or are recalcitrant e.g. *Carapa procera*. The harvested seeds are stored in a ventilated room and used to supply the village nursery (Specimens need to be sent to Kew).	Annex F, E, MSB database	
Indicator 1.3	No list of authenticated pesticide species at start of project.	The list of 25 authenticated pesticide species plus data from bioassays and field experiments	Annex E, B, C, K	

Output 2:	Active compounds/ingredients in the key pesticide plants being used by cotton producers are identified and relative effectiveness of different species established.			Comments (if necessary)
	Baseline	Change recorded by 2016	Source of evidence	
Indicator 2.1	No identified components at start of project	Components not identified at Kew due to crash in *Helicoverpa armigera* colony and lack of samples from Mali. Classes of compounds in six species were identified by DMT in Mali.	Report from Prof. Rokia (DMT) is available in Annex B.	Further work at Kew scheduled in in Y3
Indicator 2.2	No knowledge of relative effectiveness of different species at start of project.	Relative effectiveness assessed via bioassays in seven species at Kew	Half Year Report for this project and Annex K	Further work at Kew scheduled in in Y3
Indicator 2.3	No relative effectiveness and dosages of different species	Data generated on two new formulations	Annex C	

Output 3:	Four small-scale organic pesticide producers established and trained to supply optimum standard organic pesticides to cotton farmers.			Comments (if necessary)
	Baseline	Change recorded by 2016	Source of evidence	
Indicator 3.1	No farmers/small scale producers trained at start of project	July 2015 workshop: 2 facilitators from MOBIOM came together with 10 women (cooperative secretaries) for training and disseminated knowledge to all the members of their cooperative which is composed of 13 persons. December 2015 workshop: 2 facilitators from MOBIOM came together with 14	July 2015 and December 2015 workshops; photographs 2, 6	

		women (cooperative secretaries for training and disseminated knowledge to all the members of their cooperative which is composed of 13 persons.		
Indicator 3.2	No small scale supply branches of standardised pesticide products at start of project	Two cooperatives (Samaguéla and Ziékorodougou) were equipped for oil production. A system of production/supply has been established by individuals using facilities for oil extraction	Installation and equipment for cooperative supporting oil extraction: Two women cooperatives (Ziékorodougou in Sikasso and Samaguéla in Yanfolila) received equipment (press and packaging materials). During the delivery of equipment, a training session was organised in every village in March 2016: 21 women Samaguéla ; 43 women Ziékorodougou	
Indicator 3.3	No market niche for plant products at start of project.	Niche market established through *Carapa procera* oil production sales	Production was enough to supply local demand, without having to purchase it from neighbouring Guinea-Conakry as MOBIOM used to do.	Investments to be addressed in final year if possible

Output 4:	Four community demonstration gardens established to strengthen the capacity of target communities to cultivate pesticide plants. This will provide an alternative to wild plant harvesting and ensure sustainable supplies of key plants in the future.			Comments (if necessary)
	Baseline	Change recorded by 2016	Source of evidence	

Indicator 4.1	No demonstration gardens at start of project. 6.5 Ha of planting in Y1	11 hectares were planted in both 2014 and 2015 across 19 farms with 7 species	Annex E, Photographs 11, 12 and 13.	
Indicator 4.2	Unknown but limited seed collection and seedling production at start of project	19,500 plants of 7 species for the demonstration plots and members of organic cotton producers' cooperatives in the Bla area. Seed sourced from within Mali at a sufficient level.		
Indicator 4.3	No data	Data on survival and growth rate generated.	A biophysical evaluation of 3,283 pesticide plants has been extracted from the database in Sikasso and is available in Annex H)	H12=height Dec. 2015, D12 = stem diameter Dec. 2015, M=dead

Output 5:	Increased awareness of pesticide plant use for organic cotton production among policy makers in Mali (CMDT/Dept. of Agriculture/Dept. of Forestry)			Comments (if necessary)
	Baseline	Change recorded by 2016	Source of evidence	
Indicator 5.1	Limited awareness; project guidelines awaited.	The 2014 campaign results of the pesticide project were presented to the partner farmer cooperatives. MOBIOM provided a technical report of activities	(Annex A, Photograph 14).	Extension to listed policy makers in final year of project
Indicator 5.2	CMDT is not using community garden approach	CMDT has not developed community gardens		CMDT will be approached in the final year for the development of community gardens once they see the project outcomes
Indicator 5.3		CMDT and the Departments have discussed with		Definitive information on this

		stakeholders such as Helvetas, which means that a process and a methodology are in place		indicator can be provided only after the workshop on dissemination of the outcomes at a national level which will take place at the end of the project.

3.3 Progress towards the project Outcome

Outcome:	Paste here *The sustainable use and cultivation of pesticide plants for organic cotton production leads to increased income generation among target communities, and reduces the loss of plant biodiversity in southern Mali.*			Comments (if necessary)
	Baseline	Change by 2016	Source of evidence	
Indicator 1 Native pesticide plants successfully established in community demonstration gardens as farmer field schools in each of the regions by Y3	6.5 Ha in Y1	Community gardens established, 11 Ha in Y2.	Details of the structure of the cooperatives and the planted area are available in Annex I.	
Indicator 2 Yields of "first class" organic cotton increase by 5% across target communities, increasing farmers revenues and securing crop bonuses for reaching organic cotton production targets by Y3	CMDT historical yield data	Yields increased by >5% in Yanfolila and Kolondiéba using new pesticide formulations in Y2.	Annex C	
Indicator 3 All beneficiary women farmers (30% of Mobiom) have increased their income by 10 to 25% in the four	Socio-economic survey carried out at the beginning of project, (Annex J).	No new data but yield increase above encouraging		Second survey to be carried out at the end of the project

regions by Y3; All direct beneficiary men farmers have increased their income by 10 to 25% in the four regions by Y3				
Indicator 4 >25% of cotton farmers in target communities use optimum standard organic pesticide and treatment regimes, reducing wastage by Y3	Socio-economic survey carried out at the beginning of project, (Annex J).	No new data.		Figures from each farmers cooperative to be gathered by final year report
Indicator 5 Important pesticide species show marked reduction* in losses, benefitting the conservation of wild populations **(Indicator to be made SMART following the identification and authentication of exact pesticide species being used – see Output 1)*	Y1 vegetation survey appears not to have taken place			We are planning in the final year to a) survey the species harvested exclusively from the wild *in situ* and b) survey farmers if they have a changed their habits with regard to the way they collect the plants. "Do the cultivated plants supply the demand?"

3.4 Monitoring of assumptions

Assumption 1: Unaltered

Assumption 2: The 4 small-scale producers of organic pesticide can continue to source raw material needed to create the optimal pesticide for organic cotton farmers.

Comments: 1) the age of many *Carapa procera* trees has caused problems with fruit production 2) the area from which of *Balanites aegyptiaca* and *Eurphorbia paganorum* are sourced is too remote of the oil production units.

Assumption 3: The national cotton board (CMDT) maintains its support to organic cotton production and its marketing.

Comments: CMDT's support has been maintained

Assumption 4: Climatic variation does not restrict threaten the viability of pesticide plant cultivation in community gardens.

Comments: It is assumed that 2015 late rains had an effect on timing (July vs. May) of the plantation of pesticide species, hence fruit production was affected (note: 2015 was an el Niñoyear).

Assumption 5: International organic cotton prices do not fall significantly.

Comments: Regardless of the international organic cotton price fluctuation, CMDT buys cotton from producers “in advance”. So if prices fall too much and that the resale price does not cover the production cost, a “Union of Producers” which holds 60 % of sales revenues (CMDT 40%) refund the difference , thanks to a specifically provided funds for this kind of situations. The “advance” purchasing system implemented by CMDT guarantees the Malian producer against the volatility of world prices. Therefore the risk exists, but the producer is not directly affected. Indeed, this "support fund" which is made with the revenues earned during the good years – i.e. of the 60 % of annual revenue accruing to producers a percentage is taken to supply this fund - can limit this kind of risk to the cotton producer (See: http://maliactu.info/economie/compagnie-malienne-pour-le-developpement-des-textiles-qui-veut-destabiliser-la-filiere-coton)

3.5 Impact: achievement of positive impact on biodiversity and poverty alleviation

Then most significant impact on poverty by the end of the project is likely to stem from increased yield in Yanfolila and Kolondiéba based on new pesticide formulations) (Annex C). The final impact will not be known until a second socioeconomic survey is undertaken in Y3

The scale of planting of the following species listed below will certainly impact their conservation and help ensure their short term availability in Mali. In total 11 hectares were planted in both 2014 and 2015 across 19 farms. The species used were *Adansonia digitata, Khaya senegalensis, Carapa procera, Tamarindus indica, Faidherbia albida, Parkia biglobosa* and *Ziziphus mauritiana*. They have been supplied by three nurseries have produced 19,500 plants of *Adansonia digitata, Khaya senegalensis, Carapa procera, Tamarindus indica, Parkia biglobosa, Ziziphus mauritiana, Faidherbia albida* for the demonstration plots and members of organic cotton producers’ cooperatives in the Bla area. Survivorship in December 2015 was 58%. See Annex E/H.

4. Contribution to SDGs

The project’s contributions to the SDGs are to the four listed below. The specific contributions are all detailed elsewhere in this report.

- SDG 1 (End poverty)
- SDG 2 (Promote sustainable agriculture)
- SDG5 (Gender equality)
- SDG15 (Sustainable use of terrestrial ecosystems/reduce desertification/land degradation/biodiversity loss)

5. Project support to the Conventions, Treaties or Agreements)

This project aims work with the national focal points in Mali to meet their obligations under the CBD by enhancing and contributing to:

- Raising awareness of the values of (plant) biodiversity and the steps needed to conserve and use it sustainably (Aichi Target 1). Progress has been made towards this target in the first year through the questionnaires and discussion with local stakeholders.
- Governments, business and stakeholders taking steps to keep the use of natural resources well within safe ecological limits (Aichi Target 4).
- Preventing the extinction of threatened species particularly of those most in decline (Aichi Target 12).
- Sharing, transferring and applying scientific knowledge to improve the status and trends of biodiversity (Aichi Target 19).

- Assessing the conservation status of plant species to guide conservation (GSPC Target 2)
- Preserving threatened species *in-situ* and in national, *ex-situ* seed bank facilities (GSPC Targets 7 & 8);
- All wild harvested plant-based products sourced sustainably (GSPC Target 12)
- Strengthening partnerships and co-operation with appropriate national and international institutions (GSPC Target 16)

However, contact with national focal points has been limited severely by travel restrictions due to Ebola in Y1 and terrorist activity in Y2 and only IER project staff have been in a position to be in contact since the activity recorded in the Y1 report. Activity in country has contributed to all of the above except bullets 2 and 8. Evidence via Annexes/other sections of report.

6. Project support to poverty alleviation

The expected direct beneficiaries of the project are the 10,500 farmers of the 85 cooperatives under the MOBIOM umbrella in the four regions of southern/southwestern Mali. The family members of those farmers total over 100,000 people who will benefit indirectly. The project explicitly aims to improve livelihoods for that cohort of the Malian population. In Y2 the most promising indicators that income will be positively impacted are the increased yields with new pesticide formulations in Yanfolila and Kolondiéba and the sale and production of *Carapa procera* oil, which has been enabled MOBIOM not to need to source extra oil from neighbouring Guinea-Conakry for the first time in Y2, despite issues with an aging profile of trees in the regions.

7. Project support to Gender equity issues

Women constitute 3,150 of the 10,500 farmers of MOBIOM.

Training activities in Y2 have been substantially been geared towards women, for example the July and December 2015 workshops detailed under indicator 3.1.

In two cooperatives in Y2, (Samaguéla and Ziékorodougou) women undertook training on oil production, enhancing knowledge of livelihood provision. They also produced soaps for their own consumption, increasing their incomes indirectly though reducing the need to purchase soap.

Equipment was also given to women (one press per cooperative) to make oil extraction easier and more efficient. Studies will be run by IER and MOBIOM to assess whether the use of the press increases the quantity of oil produced (indicator 3.2).

8. Monitoring and evaluation

The problems in communication and travel have significantly hampered M & E efforts during Y2. In the second half of the year, they were restricted to the two week visit of IER personnel to RBG Kew in terms of the lead organisation's role. Community participatory M & E in Mali has continued via IER working with MOBIOM both in its headquarters and on farms. The socioeconomic and farmer survey work undertaken in Y3 will be important in delivering M & E. We are looking into employing an M & E consultant that is able to travel to Mali in Y3 to address the problems accrued.

9. Lessons learnt

In Mali, the size of demonstration plots and their protection (fence) should have been more carefully planned because of water shortages and animal encroachments.

Knowledge exchange among farmers has proved to be key in developing and managing methods and systems of organic cotton production involving pesticide plant use.

Overall the project has been significantly impacted by Ebola, terrorism and PI change, none of which could have been foreseen at the project outset. In particular it has impacted communication between the UK and Mali and within Mali, and the ability of the lead partner to be engaged in field activity and workshops

10. Actions taken in response to previous reviews (if applicable)

The change in PI has meant that is has not been possible to address all of the comments and suggestions in the review of the Y1 report. We have been able in this report to provide translations of all the Annexes and to summarise progress on the logframe below. The other comments have been addressed as far as the managerial change and other external circumstances have allowed.

11. Other comments on progress not covered elsewhere

Experiments in the field with new pesticide formulas represent a risk with regard to the outcome and the yield of the farmer. This could be negative and it is a risk for farmers. In subsequent years, a farmer may not accept to be part of the experiment if he/she experienced a worse yield the year before after adopting new formulations promoted by the project.

Other difficulties in the project have been covered elsewhere.

During Y2 of the project, the lead counterpart in IER, Sidi Sanogo, has successfully defended his PhD thesis in Applied Biological Sciences at the Faculty of Science in Bio-Engineering of the University of Ghent (Belgium) entitled “Essais de germination et conservation de fruits et graines de quelques espèces ligneuses à usages multiples au Mali”. Sidi is now Head of the Forestry Seeds Herbarium Unit and the Regional Centre for Agricultural Research in Sikasso, Mali.

In addition, three MSc students have undertaken research on propagation and production techniques in *Cordyla pinnata*, *Ximenia americana* and *Securidaca lonigipedunculata*. 25 undergraduate students have also obtained training associated with the project.

12. Sustainability and legacy

The initial strategy to deliver sustainability and legacy via IER and its ability to influence the national governmental Forestry and Agriculture Departments within Mali still stands. We also intend to link the final phases of the project to a second RBG Kew project, the Mali component of the Useful Plants Project (UPP). This is currently in its final dissemination phase, and we will feed back Mali Cotton project use data and its validation to the communities of back to community via UPP. UPP provided the original support and basis for this project, and the link to the first in-country farmers’ group. The new partnership described above with DMT in Bamako and its departmental head Dr. Rokia Sanogo has consolidated collaboration with IER, promoting in country research and providing a link to policy makers; Dr. Sanogo is highly influential with government and advises the Prime Minister. Dr Sidi Sanogo’s PhD, obtained partly via his engagement with the project and subsequent promotion to Head of Research at IER also increases his influence and ability to deliver lasting impact for the project’s outcomes.

13. Darwin Identity

When results were disseminated to farmers, a local radio presenter was present and was hired to broadcast in local language the result of this project funded by the Darwin Initiative. All reports contain the Darwin Initiative logo.

A Facebook page was created on 15th June 2015: https://www.facebook.com/darwinmalicotton/. It describes project objectives, the challenges to address and the different activities carried out supported by photographs. On 30th June 2016 the page 17 likes, 73 people reached and 38 page views.

A first Twitter post (https://twitter.com/eligmocarpus/status/745927354548166658) advertising the web page has been produced on 23rd June 2016. On 30th June 2016 it had been retweeted 4 times, with 2 likes.

We are investigating providing species use guidelines in video format (mp3) in Y3.

14. Project Expenditure

Please expand and complete Table 1.

Table 1 Project expenditure during the reporting period (1 April 2015 – 31 March 2016)

Project spend (indicative) since last annual report	2015/16 Grant (£)	2015/16 Total Darwin Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs (see below)			75	Reduced funding to MOBIOM due to communication chain issues through IER
Consultancy costs			6	Reduced funding to MOBIOM due to communication chain issues through IER
Overhead Costs			40	Reduced funding to MOBIOM due to communication chain issues through IER
Travel and subsistence			41	RBG, Kew travel restrictions due to terrorist activity in Mali and Burkina Faso & reduced funding to MOBIOM due to communication chain issues through IER
Operating Costs			39	Replacement of former PI with non seed researcher prevented seed research activity.
Capital items (see below)			36	Reduced funding to MOBIOM due to communication chain issues through IER
Others (see below)				
TOTAL	**87, 194**	**34, 028.37**		

Highlight any agreed changes to the budget and **fully** explain any variation in expenditure where this is +/- 10% of the budget. Have these changes been discussed with and approved by Darwin?

Annex 1: Report of progress and achievements against Logical Framework for Financial Year 2015-2016

Project summary	Measurable Indicators	Progress and Achievements April 2015 - March 2016	Actions required/planned for next period
Impact The sustainable use and cultivation of useful native plants support biodiversity conservation and poverty reduction in rural Mali.		Most significant progress: 1) Yields increased by >5% in Yanfolila and Kolondiéba using new pesticide formulations 2) *Carapa procera* oil production was enough to supply local demand, without having to purchase it from Guinea as MOBIOM used to do. Scale of planting of pesticide species now 11 ha in total, supplying 19500 plants of 7 species to project activities	[redacted]
Outcome The sustainable use and cultivation of pesticide plants for organic cotton production leads to increased income generation among target communities, and reduces the loss of plant biodiversity in southern Mali.	1. Native pesticide plants successfully established in community demonstration gardens as farmer field schools in each of the regions by Y3 2. Yields of 'first class' organic cotton increase by 5% across target communities, increasing farmers' revenues and securing crop bonuses for reaching organic cotton production targets by Y3. 3. All beneficiary women farmers (30% of MOBIOM) have increased their income by 10 to 25% in the four regions by Y3; All direct beneficiary men farmers	Community gardens established, 11 Ha in Y2. Yields increased by >5% in Yanfolila and Kolondiéba using new pesticide formulations in Y2. No new data beyond Y1 socioeconomic survey but yield increase above encouraging	Second survey to be carried out at the end of the project Figures from each farmers cooperative to be gathered by final year report

Project summary	Measurable Indicators	Progress and Achievements April 2015 - March 2016	Actions required/planned for next period
	have increased their income by 10 to 25% in the four regions by Y3 4. >25% of cotton farmers in target communities use optimum standard organic pesticide and treatment regimes, reducing wastage by Y3 5. Important pesticide species show marked reduction* in losses, benefitting the conservation of wild populations	No new data beyond Y1 socioeconomic survey Y1 vegetation survey appears not to have taken place	We are planning in the final year to a) survey the species harvested exclusively from the wild in situ and b) survey farmers if they have a changed their habits with regard to the way they collect the plants. "Do the cultivated plants supply the demand?"
Output 1. Identification and authentication of pesticide species currently used by organic cotton farmers in target communities	1. Established base list of pesticide species collated from desk study and questionnaires addressed to organic cotton farmers in the 4 Regions of Mali 2. Collections of specimens of seeds and herbarium vouchers of pesticide species 3. List of authenticated pesticide species with confirmed scientific and vernacular names	Base list of 25 species established from desk study and questionnaires in the 4 regions of Mali 89 voucher specimens and 30 seed accessions collected and stored in Mali. Other seed collections made and used for oil extraction/training or are recalcitrant e.g. *Carapa procera*. The harvested seeds are stored in a ventilated room and used to supply the village nursery (Specimens need to be sent to Kew). The list of 25 authenticated pesticide species plus data from bioassays and field experiments Indicators appropriate	
Activity 1.1 Survey through questionnaires and desk study on pesticide plant species used in organic cotton production in Mali		Data entry into the database described in the Y1 report has continued for 25 species. These data describe different types of local preparation pesticide extracts, farmers' dosages and frequency of use of these bio-pesticides in addition to taxonomic and distribution data.	
Activity 1.2 Field trips and collection of pesticide species specimens (known scientific and local names, seeds, herbarium specimens and photographs)		Biopesticide tests, plant production, propagation in laboratory and specimens were collected for 18 species. Botanical surveys were carried out by the Forestry program team to observe the seeded plots.	
Activity 1.3 Verification research on collected specimens at Kew Herbarium and MSB		The Forestry program team conducted germination and conservation of tests on the collected seeds. The seeds of pesticidel and food species were harvested for the production of plants.	

Project summary	Measurable Indicators	Progress and Achievements April 2015 - March 2016	Actions required/planned for next period
Activity 1.4 Compilation of data from Kew and other databases, regarding candidate species seed collecting, handling, germination and propagation. Preparation of species pages (including field photographs).		Data compilation: all available data including those from ethnobotanical surveys are now included in the database. Species page produced for *Carapa procera*.	
Output 2. Active compounds / ingredients in the key pesticide plants being used by cotton producers are identified and relative effectiveness of different species established.	1. Identification of chemical composition of the key pesticide species 2. Establishment of relative effectiveness of different species 3. Establishment of effectiveness and dosages of combined ingredients of different key species that cotton producers are to use	Components not identified at Kew due to crash in *Helicoverpa armigera* colony and lack of samples from Mali. Classes of compounds in six species were identified by DMT in Mali. Relative effectiveness assessed via bioassays in seven species at Kew Data generated on two new formulations Indicators appropriate	
Activity 2.1. Collection of specimens for by-product extraction and study in the laboratories in Mali and at Kew and efficient extractions by communities in Mali		Collecting of pesticide plant organs continued in villages with the support of facilitators and supervisors. Specimens of collected organs of pesticide plants were packaged in the Laboratory of entomology. Tests which studied the effectiveness of bio-pesticide products installed in the farm (cotton fields) and which were carried out in August were completed in November 2015. Species and formulation used were as follows: - Former formulation: seed extracts of *Azadirachta indica* + oil of *Carapa procera* - New formulation (1): stem extracts of *Euphorbia paganorum* + bark extract of *Khaya senegalensis* + oil of *Carapa procera* - New formulation (2): plant extract of *Chamaecrista nigricans* + stem extracts of *Euphorbia paganorum* + oil of *Balanites aegyptiaca*	
Activity 2.2. Bio-assay and identification of chemical composition of collected specimens, mainly at Kew		The six species sent to Kew were evaluated as feeding repellents against cotton bollworm, *Helicoverpa armigera*. They were *Carapa procera*, *Chamaecrista nigricans*, *Khaya senegalensis*, *Securidaca longipedunculata*, *Bobgunnia madagascariensis* and *Balanites aegyptiaca*. Feeding was repelled by *C. nigricans* and stimulated by extracts from the other species. Further research is needed in Y3 to evaluate the toxic effects of the compounds on the insects in the time period after feeding. *Helicoverpa armigera* supply issues now appear to be resolved and further samples need to be transferred from Mali. Tests	

Project summary	Measurable Indicators	Progress and Achievements April 2015 - March 2016	Actions required/planned for next period
		on extracts from 23 species were undertaken in Mali. Five showed high levels of effectiveness against cotton pests.	
Activity 2.3 Tests on pests of the extracted compounds in the field with communities, leading to standardisation of ingredients/composition and guidelines for use		The seed/cotton yields of new formulations (1) and (2) exceeded those of the former formulation: mean 390.6 Kg / ha against 320.3 kg / ha in Yanfolila (New formulation 1); 422 kg / ha against 343.8 kg / ha in Kolondiéba (New formulation 2).	
Output 3. Four small-scale organic pesticide producers established and trained to supply optimum standard organic pesticides to cotton farmers	1. 10 farmers from the 4 regions and MOBIOM technical team trained in producing optimum standard plant-based products for organic crop production	July 2015 workshop: 2 facilitators from MOBIOM came together with 10 women (cooperative secretaries) for training and disseminated knowledge to all the members of their cooperative which is composed of 13 persons. December 2015 workshop: 2 facilitators from MOBIOM came together with 14 women (cooperative secretaries for training and disseminated knowledge to all the members of their cooperative which is composed of 13 persons.	
	2. Small-scale supply branches of standardised pesticide products set up in each of the 4 regions managed by the trained farmers as inputs	Two cooperatives (Samaguéla and Ziékorodougou) were equipped for oil production. A system of production/supply has been established by individuals using facilities for oil extraction	
	3. Specific market niche of plant products and investments established	Niche market established through *Carapa procera* oil production sales Indicators appropriate	
Activity 3.1 Develop improved methods for harvesting and efficient protocols for by-product extraction that optimise bioactivity and reduce over-collection and wastage		Studies of extraction of *Balanites aegyptiaca* and *Zanthoxylum zanthoxyloides* oils for use as adjuvants is being carried out in the Laboratory of Forestry programme	
Activity 3.2 Training workshops for pesticide producers on preparation and presentation of standardised products (at least two trainer farmers per region)		A training session was organised in July 2015 on the oil extraction techniques of *Carapa procera*. Ten women from cooperatives in Bougouni and Yanfolila have benefited from this training. Three nurserymen were trained in harvesting techniques of seeds and plant production techniques in the province of Bla. Further farmers were trained in planting techniques and plot-based pesticide plants and food plants were installed in the farms	
Activity 3.3 Develop IPR, farmers' ownership and product registration protocols for organic cotton production according to the regulations in		In December 2015, training in techniques for extracting oil from pesticide plants: A training session was held on techniques for extracting oil from *Balanites aegyptiaca*. Ten (10) women's cooperatives Mobiom of Bla,	

Project summary	Measurable Indicators	Progress and Achievements April 2015 - March 2016	Actions required/planned for next period
place in Mali		Kolondiéba, Kita and Kolokani benefited from this training. The training was followed by an initiation session on the preparation and use of biopesticide products. Further activity in this area scheduled for Y3.	
Activity 3.4 Exploit local industrial investment opportunities and economic markets to promote the use of optimum standard organic pesticides, similar to the traditional medicine model in Mali		Activity in this area scheduled for Y3	
Output 4. Four community demonstration gardens established to strengthen the capacity of target communities to cultivate pesticide plants. This will provide an alternative to wild plant harvesting and ensure sustainable supplies of key plants in the future	1. Establishment and maintenance of demonstration gardens of at least 1ha in each of the 4 Regions, planted with key pesticide species seedlings 2. Seed supply and increased seedling production of pesticide species in nurseries to ensure individual needs and continuity of cultivation 3. Assessing and annually collecting data on survival and growth of seedlings in the plots**.**	11 hectares were planted in both 2014 and 2015 across 19 farms with 7 species 19,500 plants of 7 species for the demonstration plots and members of organic cotton producers' cooperatives in the Bla area. Seed sourced from within Mali at a sufficient level. Data on survival and growth rate generated via a biophysical evaluation of 3,283 pesticide plants Indicators appropriate	
Activity 4.1. Generate data on propagation methods for listed pesticide plant species, rare and/or commonly used by farmers in the four regions (also for journal articles)		The production of plants is underway in three nurseries in Segou and Sikasso as described in the Y1 report. The species being produced are: *Adansonia digitata, Khaya senegalensis, Tamarindus indica, Ziziphus mauritiana, Carapa procera* and *Parkia biglobosa*. An example of information on propagation methods as well as plant description, phenology, distribution, usage, collection and seed conservation and trade is available for *Carapa procera*.	
Activity 4.2. Train, collect seeds of selected key species and produce enough seedlings in communities nurseries		Equipment and training of community nursery cultivators:stakeholders from 3 nurseries in Bla (2 from the village of Niala and 1 village from Kégnésso) were equipped (nursery material and seeds) and trained in harvesting techniques of seed and seedling production in February 2016	
Activity 4.3 Plant out seedlings in communal demonstration plots (at least 1ha x 4) and establish community ownership for long term management and further development.		In total 11 hectares were planted in both 2014 and 2015 across 19 farms. The species used were *Adansonia digitata, Khaya senegalensis, Carapa procera, Tamarindus indica, Faidherbia albida, Parkia biglobosa* and *Ziziphus mauritiana*. They have been supplied by three nurseries and	

Project summary	Measurable Indicators	Progress and Achievements April 2015 - March 2016	Actions required/planned for next period
		have produced 19500 plants of *Adansonia digitata, Khaya senegalensis, Carapa procera, Tamarindus indica, Parkia biglobosa, Ziziphus mauritiana, Faidherbia albida* for the demonstration plots and members of organic cotton producers' cooperatives in the Bla area. Maintenance, monitoring and protection of demonstration plots: plots of pesticide and food plants set up in 2014 and 2015 were monitored, protected and evaluated. The biophysical evaluation (measurement of height and diameter) was conducted during the month of December 2015. During all the dry season, farmers watered the plants and monitored plots against wandering animals	
Activity 4.4 Organise farmer and NGO workshops to inform the wider farming community about sustainable use of pesticide plants and their cultivation.		Activity deferred to Y3. We have started to plan a regional workshop which would be run in partnership with the matching project funders (TRAID) and Prof. Stevenson's OPTIONS project late in Y3 to be held in a venue to which travel by UK residents can be authorised, with Benin, Ghana and Senegal under consideration. Project co-operative representatives and policymakers from Mali will attend and transfer knowledge back to Mali.	
Activity 4.5 The benefits of cultivating pesticide plants for organic production promoted through farming fairs, exhibitions (video) and local radio.		Scheduled for Y3.	
Activity 4.6 Reproduction of guide/hand book, leaflets and posters through Kew Publishing (in local language)		Scheduled for Y3	
Output 5. Increased awareness of pesticide plant use for organic cotton production among policy makers in Mali (CMDT/Dept. of Agriculture/Dept. of Forestry)	1. CMDT/Agriculture/Forestry use project guidelines for managing native pesticide plants 2. Dept. of Agriculture and Forestry recognise the importance of local useful trees/plants and work on reversing farming practices focus on land clearing before planting crops 3. CMDT/Agriculture/Forestry integrate the ecological resilient of farming system in rural	The 2014 campaign results of the pesticide project were presented to the partner farmer cooperatives. MOBIOM provided a technical report of activities CMDT has not developed community gardens. CMDT and the Departments have discussed with stakeholders such as Helvetas, which means that a process and a methodology are in place	

Project summary	Measurable Indicators	Progress and Achievements April 2015 - March 2016	Actions required/planned for next period
	communities' development	Indicators appropriate	
Activity 5.1. Present research findings and guidance to and organise farmers' field visits of woodlots for CMDT directorate who provides technical advice to farmers regarding cotton production		The 2014 campaign results of the pesticide project were presented to the partner farmer cooperatives. MOBIOM provided a technical report of activities	
Activity 5.2. Present project findings and guidance to and organise farmers' field visits of woodlots for Dept. of Agriculture directorate who provides technical advice to farmers regarding sustainable farming		Activity deferred to Y3 in country activity.	
Activity 5.3 Present project findings and guidance to and organise farmers' field visits of woodlots for Dept. of Forestry who manages and advises farmers regarding conservation and sustainable use of non-timber forest products.		Activity deferred to Y3. We anticipate that this will take place in country via IER and by attendance at the workshop described under activity 4.4 by Dept. of Forestry personnel.	

Annex 2. Project's full current logframe as presented in the application form (unless changes have been agreed)

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Impact: The sustainable use and cultivation of useful native plants support biodiversity conservation and poverty reduction in rural Mali. Effective contribution in support of the implementation of the objectives of the Convention on Biological Diversity (CBD), the Convention on Trade in Endangered Species (CITES), and the Convention on the Conservation of Migratory Species (CMS), as well as related targets set by countries rich in biodiversity but constrained in resources.			
Outcome: The sustainable use and cultivation of pesticide plants for organic cotton production leads to increased income generation among target communities, and reduces the loss of plant biodiversity in southern Mali.	1. Native pesticide plants successfully established in community demonstration gardens as farmer field schools in each of the regions by Y3 2. Important pesticide species show marked reduction* in losses, benefitting the conservation of wild populations 3. Yields of 'first class' organic cotton increase by 5% across target communities, increasing farmers' revenues and securing crop bonuses for reaching organic cotton production targets by Y3. 4. All beneficiary women farmers (30% of MOBIOM) have increased their income by 10 to 25% in the four regions by Y3; All direct beneficiary men farmers have increased their income by 10 to 25% in the four regions by Y3 5. >25% of cotton farmers in target communities use optimum standard organic pesticide and treatment regimes, reducing wastage by Y3	1. Technical reports on species woodlots by IER, MOBIOM and Kew 2. Vegetation surveys in the four regions at beginning and end of project 3. MOBIOM annual reports; Household surveys and questionnaire, and reports 4. MOBIOM annual reports; Household surveys and questionnaire, and reports 5. Household surveys and questionnaire, and technical reports	1. Plant propagation and analytical research on the target pesticide species does not prove to be exceptionally difficult. 2. The 4 small-scale producers of organic pesticide can continue to source raw material needed to create the optimal pesticide for organic cotton farmers. 3. The national cotton board (CMDT) maintains its support to organic cotton production and its marketing. 4. Climatic variation does not restrict threaten the viability of pesticide plant cultivation in community gardens. 5. International organic cotton prices do not fall significantly.

Outputs: 1. Identification and authentication of pesticide species currently used by organic cotton farmers in target communities	1a. Established base list of pesticide species collated from desk study and questionnaires addressed to organic cotton farmers in the 4 Regions of Mali 1b. Collections of specimens of seeds and herbarium vouchers of pesticide species 1c. List of authenticated pesticide species with confirmed scientific and vernacular names	1.. Verified base list of organic species established and published	Plant research investigations are successful and not particularly challenging for the target species. The risks of challenging research on important compounds and extraction methods can affect the standardisation of pesticide products. However the combined expertise of Kew and NRI will be mobilised to minimise these risks.
2. Active compounds / ingredients in the key pesticide plants being used by cotton producers are identified and relative effectiveness of different species established	2a. Identification of chemical composition of the key pesticide species 2b. Establishment of relative effectiveness of different species 2c. Establishment of effectiveness and dosages of combined ingredients of different key species that cotton producers are to use	2. Key pesticide species used by cotton producers been studied and their relative effectiveness established and published	Plant research investigations are successful and not particularly challenging for the target species. The risks of challenging research on important compounds and extraction methods can affect the standardisation of pesticide products. However the combined expertise of Kew and NRI will be mobilised to minimise these risks.
3. Four small-scale organic pesticide producers established and trained to supply optimum standard organic pesticides to cotton farmers	3a. 10 farmers from the 4 regions and MOBIOM technical team trained in producing optimum standard plant-based products for organic crop production 3b. Small-scale supply branches of standardised pesticide products set up in each of the 4 Regions managed by the trained farmers as inputs 3c. Specific market niche of plant products and investments established	3. A standardised production unit and usage methods of pesticide plant products created in each of the regions for organic farmers	Community members remain engaged, receptive to training and provide labour and land for growing and maintaining priority species in the woodlots. This risk is minimised because organic production is the identity of the target MOBIOM group of farmers, who had already approached Kew to request a support in cultivating native pesticide species

4. Four community demonstration gardens established as farmer field school approach to strengthen the capacity of target communities to cultivate pesticide plants. This will provide an alternative to wild plant harvesting and ensure sustainable supplies of key plants in the future.	4a. Establishment and maintenance of demonstration gardens of at least 1ha in each of the 4 Regions, planted with key pesticide species seedlings 4b. Seed supply and increased seedling production of pesticide species in nurseries to ensure individual needs and continuity of cultivation 4c. Assessing and annually collecting data on survival and growth of seedlings in the plots	4. A community garden/woodlot of pesticide plant species created in each of the four regions	Seed germination and seedling production of the target pesticide species prove to be exceptionally difficult. Seed germination of many wild species is not always straightforward and can be tricky in terms of their dormancy breaking (seed pre-treatments and handling) and their growth in the nursery. However, Kew's excellent seed laboratory and expertise will help overcome any such challenges within the project life time.
5. Increased awareness of pesticide plant use for organic cotton production among policy makers in Mali (CMDT/Dept. of Agriculture/Dept. of Forestry)	5a. Assessing and annually collecting data on survival and growth of seedlings in the plots 5b. Dept. of Agriculture and Forestry recognise the importance of local useful trees/plants and work on reversing farming practices focus on land clearing before planting crops 5c. CMDT/Agriculture/Forestry integrate the ecological resilient of farming system in rural communities' development	5. Reference materials for the identification and cultivation of key pesticide species in Mali produced and distributed to farmers	No risk/assumption in logframe

Activities (each activity is numbered according to the output that it will contribute towards, for example 1.1, 1.2 and 1.3 are contributing to Output 1)

1.1 Survey through questionnaires and desk study on pesticide plant species used in organic cotton production in Mali

1.2 Field trips and collection of pesticide species specimens (known scientific and local names, seeds, herbarium specimens and photographs)

1.3 Verification research on collected specimens at Kew Herbarium and MSB

1.4 Compilation of data from Kew and other databases, regarding candidate species seed collecting, handling, germination and propagation. Preparation of species pages (including field photographs).

2.1 Collection of specimens for by-product extraction and study in the laboratories in Mali and at Kew and efficient extractions by communities in Mali

2.2 Bio-assay and identification of chemical composition of collected specimens, mainly at Kew

2.3 Tests on pests of the extracted compounds in the field with communities, leading to standardisation of ingredients/composition

and guidelines for use

3.1 Develop improved methods for harvesting and efficient protocols for by-product extraction that optimise bioactivity and reduce over-collection and wastage

3.2 Training workshops for pesticide producers on preparation and presentation of standardised products (at least two trainer farmers per region)

3.3 Develop IPR, farmers' ownership and product registration protocols for organic cotton production according to the regulations in place in Mali

3.4 Exploit local industrial investment opportunities and economic markets to promote the use of optimum standard organic pesticides, similar to the traditional medicine model in Mali

4.1 Generate data on propagation methods for listed pesticide plant species, rare and/or commonly used by farmers in the four regions (also for journal articles)

4.2 Train, collect seeds of selected key species and produce enough seedlings in communities nurseries

4.3 Plant out seedlings in communal demonstration plots (at least 1ha x 4) and establish community ownership for long term management and further development.

4.4 Organise farmer and NGO workshops to inform the wider farming community about sustainable use of pesticide plants and their cultivation.

4.5 The benefits of cultivating pesticide plants for organic production promoted through farming fairs, exhibitions (video) and local radio.

4.6 Reproduction of guide/hand book, leaflets and posters through Kew Publishing (in local language)

5.1 Present research findings and guidance to and organise farmers' field visits of woodlots for CMDT directorate who provides technical advice to farmers regarding cotton production

5.2 Present project findings and guidance to and organise farmers' field visits of woodlots for Dept. of Agriculture directorate who provides technical advice to farmers regarding sustainable farming

5.3 Present project findings and guidance to and organise farmers' field visits of woodlots for Dept. of Forestry who manages and advises farmers regarding conservation and sustainable use of non-timber forest products.

Annex 3 Standard Measures

Please expand and complete Table 1: new projects should complete the Y1 column and also indicate the number planned during the project lifetime. Continuing project should cut and past the information from previous years and add in data for the most recent reporting period. Quantify project standard measures over the last year using the coding and format from the Darwin Initiative Standard Measures (see website for details: http://darwin.defra.gov.uk/resources/) and give a brief description. Please list and report on relevant Code No's. only. The level of detail required is specified in the Standard Measures Guidance notes under 'definitions and reporting requirements' column. Please devise and add any measures that are not captured in the current list. Please note that these measures may not be a substitute for output level objectively verifiable indicators in the project logframe.

Table 1 Project Standard Output Measures

Code No.	Description	Gender of people (if relevant)	Nationality of people (if relevant)	Year 1 Total	Year 2 Total	Year 3 Total	Total to date	Total planned during the project
Established codes								
1B	Dr. Sidi Sanogo's PhD	M	Malian		1			1
2	3 s MSc students (6 months training)	M	Malian		3			3
4A 4B 4C 4D	Undergrad no. Training weeks Postgrad no. Training weeks				25 162.5 3 88			 3

In Table 2, provide full details of all publications and material produced over the last year that can be publicly accessed, e.g. title, name of publisher, contact details, cost. Mark (*) all publications and other material that you have included with this report.

Table 2 Publications

Title	Type (e.g. journals, manual, CDs)	Detail (authors, year)	Gender of Lead Author	Nationality of Lead Author	Publishers (name, city)	Available from (e.g.weblink or publisher if not available online)
Gravimetric sorting to improve germination of Anogeissus leiocarpa	Journal article	Sanogo, S., Sacande, M.* and Van Damme, P.	M	Malian	Seed Science and Technology Vol: 43 318-323	http://www.ingentaconnect.com/content/ista/sst

seed lots		2015				
Guide d'identification des arbres du Mali	Book	Sacande, M., Sanogo, S. * Beentje, H. 2016	M	Malian	Kew: Royal Botanic Gardens, Kew	http://www.kew.org/business-centre/kew-publishing
Essais de germination et conservation de fruits et graines de quelques espèces ligneuses à usages multiples au Mali.	PhD Thesis	Sanogo, S. 2015	M	Malian	University of Ghent, Belgium	University of Ghent, Belgium

Annex 4 Onwards – supplementary material (optional but encouraged as evidence of project achievement)

Supplied as annexes A-K and Photographs 1-14

Checklist for submission

	Check
Is the report less than 10MB? If so, please email to Darwin-Projects@ltsi.co.uk putting the project number in the Subject line.	Y
Is your report more than 10MB? If so, please discuss with Darwin-Projects@ltsi.co.uk about the best way to deliver the report, putting the project number in the Subject line.	N
Have you included means of verification? You need not submit every project document, but the main outputs and a selection of the others would strengthen the report.	Y
Do you have hard copies of material you want to submit with the report? If so, please make this clear in the covering email and ensure all material is marked with the project number.	N
Have you involved your partners in preparation of the report and named the main contributors	Y
Have you completed the Project Expenditure table fully?	Y
Do not include claim forms or other communications with this report.	