

# **The Development of the Peanut Sector for Guyana and Selected Caribbean Countries (UFL 155)**

**Final Report (2007 – 2012)**

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## **Final Summary -**

**Overall Goal:** The goal of this project was to address the limitations in peanut production in Guyana and Haiti. In Guyana, the goal in the Rupununi region is to advance upon the existing technologies adopted and utilized by the growers during the past 5 year Peanut CRSP project (UFL 52). Focus areas in both Guyana and Haiti included improving primary production, harvesting, and storage at the grower level and quality assurance and aflatoxin and to assess the social changes occurring at the village level in Guyana. These social changes in Guyana are a direct result of the development of the cottage industries initiated at the end of the previous project. Peanut production is the primary means of income for many peoples in developing countries. However, production is often at the subsistence level, resulting in poor yields and quality. Poor economic conditions continue in these areas, and farmers cannot make meaningful strides in advancing their lives or the lives of the villagers. The goals of this project seek to provide assistance at many levels of peanut production, resulting in better economic returns and an increase in the commonwealth of the respective regions.

**Cap Haitien, Haiti - Technical Achievements:** In 2008, we initiated contacts with Patricia Wolff and Tom Stehl of Meds and Foods and for Kids (MFK), an NGO in Cap Haitien, Haiti and signed an agreement with this group to assist with peanut production in the region. This organization provides a peanut-based food supplement (Medika Mamba) to orphaned children, which they hoped to purchase locally grown peanuts. Initial trips observed the farming practices of the growers to determine issues with low production and aflatoxin management. In subsequent visits we provided Creole translated peanut production guides, based on our work in Guyana, and held several production workshops at local villages in Northern Haiti. With Peanut CRSP support, we hired a local agronomist through MFK to help facilitate trainings in country. During the first year, this person had severe medical problems and was not able to continue employment, so we shifted support to Mr. Jamie Rhoads, an employee of MFK, and helped train him as a peanut agronomist. Mr. Rhoads worked closely with Peanut CRSP on two primary levels: 1) field based training on all aspects of peanut production and 2) peanut processing at the MFK factory that produces Medika Mamba, with a strong emphasis on aflatoxin detection and management. More specifically, he was responsible for the MFK agronomic efforts (grower education, research studies, supervision of field technicians, aflatoxin monitoring, and purchase of grower stock peanuts) but he was also critical for the day-to-day operations of the MFK Medika Mamba production and the building of a new factory.

Our program provided soil analysis to determine soil fertility needs, evaluated local variety performance, assessed disease incidence and discussed current management practices with growers. This provided the platform for trainings and interpretation of the production guide. Our program provided several trainings for growers during U.S. scientist visits – approximately 2 per year with about 30 growers in attendance at each meeting. In addition, Jamie Rhoads conducted about 6 trainings per year with about 30 growers each time. In conjunction with extension related trainings, research trials have continued in northern Haiti and in conjunction with MFK to assess peanut varieties from ICRISAT. These varieties (Valencia market type) have significant resistance to peanut rust and offer growers in Haiti the opportunity to improve yields with less need for protection with fungicides. Efforts were established to increase seed production from the most promising lines from ICRISAT. In 2012, the Peanut CRSP team and colleagues from MFK travelled to the Dominican Republic to meet with large-scale peanut farmers from Nicaragua to discuss the possibility of seed production for Haiti in that country. Research trials have been established to assess the value of fungicides and phosphorus inputs for improved production of Haitian peanuts. Based upon previous studies, lack of phosphorus in the soil and protection from leaf spot and rust diseases significantly reduce yield potential in Haiti. Current studies should document the impact on yield that results from combined use of fungicides (chlorothalonil) and phosphorus. Perhaps most importantly, Peanut CRSP team members and MFK colleagues established contact with a distributor in the Dominican Republic who can provide needed inputs, to include fungicides and phosphorus. Education on peanut production and demonstrations of assessing peanut maturity were provided by CRSP team members to agricultural professionals and NGO advisors. Topics included general education on the peanut crop and production, weed and insect management, disease and aflatoxin management, and other factors. The Peanut CRSP manual for peanut production in the Rupununi region of Guyana, translated into Haitian Creole, was used as the manual for this course. The course was conducted over two days in association with Mr. Graham Huff and the organization League of Hope. Graduate students from the University of Georgia, Mr. Abraham Fulmer and Ms. Marian Luis, were able to conduct portions of their thesis research (management of leaf spot and leaf rust diseases and management of aflatoxin, respectively) in Haiti during 2012.

Some of the most significant accomplishments by our efforts have included improved storage capabilities of peanuts at the MFK factory in Cap Haitien and improved processing capabilities at the MFK factory. The advances in storage and handling facilitated by the collaboration between Peanut CRSP and MFK have been an essential element as MFK completed construction of a new factory, also near Cap Haitien. Through the combined efforts of Peanut CRSP and Frank Nolin (Peerless Manufacturing, Inc.) we have worked closely with the former and newly built MFK processing facility to provide expertise in peanut storage and processing. Equipment that has been installed and factory tested include a peanut dryer with 1600 pound holding capacity, 1 ton per hour 3 stage peanut sheller with sizing shaker, splitter/blancher with aspiration and picking table, farmer's stock cleaner with stick and sand removal as well as de-stoner, and an aspiration and picking table. We have also worked closely with Jamie Rhoads and factory personnel on detecting, monitoring and preventing aflatoxin. This has also included the use of VICAM test strips and more precise testing to determine levels of the toxin in raw farmer stock peanuts, and also processed peanut butter.

Rupununi, Guyana - Technical Achievements: The achievements in Guyana are also significant in the areas of improving field production and also improving peanut utilization through peanut butter-based child-feeding programs. These areas are tightly linked, since peanut butter manufacture in the cottage industries relies directly on local production of quality peanuts. We have focused our efforts on all phases of field production through final product distribution, either whole-sale raw peanuts to intermediaries or to the local cottage industries. We have also provided support to the cottage industries in several aspects of operation including business training, aflatoxin and quality control, storage and processing. These areas, both field and cottage industry, are detailed below. Field trials were conducted in 2008 in Region 1 – Mabaruma to test the adaptation and utilization of runner peanut cultivars and the response of technical inputs of lime and phosphorus fertilizer. We met with the regional agricultural officer and worked with a local grower to establish the plots. Production guides were distributed to local growers in the region. Unfortunately the agricultural officer and the community lost interest, so further work in this region was not continued. All remaining field trials were conducted in Region 9 (Rupununi) centered within the Aranaputa village in the north. In 2008, our in-country NGO partner (Society for Sustainable Operational Strategies S-SOS), worked with the Aranaputa village council to sign a 50 year lease on two small farms, one of which is used for community farming projects – 14 acres, while the other farm (5 acres) has been designated for applied research.

In 2009, 8 varieties were tested at two different farms in the Aranaputa village. Yield, maturity and disease resistance were the primary evaluation parameters. Growers showed greater interest in the newer varieties compared to previous years. In 2010 and also in 2011, Peanut CRSP provided southeastern US varieties (peanut seeds) to growers in Aranaputa for use on their farms. Some of these lines from 2010 were re-distributed in 2011, so a significant acreage in the village can be attributed to Peanut CRSP introduced varieties. These lines have resulted in increased yield and quality of peanut butter when used in the local cottage industry. In 2011, Alyssa Cho, a graduate student from the University of Florida, under the supervision of Dr. Greg MacDonald, conducted field research trials at the community based research farm. Her research has been well received by both the local community and local governments and highlight in field days showcasing this research to local growers. Variety improvement in terms of yield, disease resistance and harvest-ability was the most desired by local growers. There was also tremendous interest was generated from maize being planted and grown for chicken feed and some interest in intercropping with cassava. We also worked some with alternative crops but these proved to be difficult to grow and maintain. Drip irrigation for vegetables was thought to be a viable production practice in the dry season, but there was little interest. Ultimately an integrated system with livestock was the goal of many growers, with peanut as the central crop. All trials were repeated in 2012 with the peanut variety trial comparing yield, grade and disease tolerance of several U.S. and Bolivian cultivars to the local standard, Guyana Jumbo. The primary diseases of the region were early leaf spot and peanut rust. Unlike 2011, the local variety performed equally to, or better than the other varieties in both yield and disease incidence. The intercropping study looked at substituting peanut within a traditionally spaced cassava planting to determine if peanut could be successfully grown as an intercrop. Maize intercropping with peanut was also studied. Cassava had no impact of yield and grade of peanut, and did not influence physiological parameters such leaf area, leaf weight and other factors associated with foliar canopy development. Maize however, did impact

peanut, even though maize was not planted until 60 days after peanut. It is suspected that light interception was the primary cause of the impact. Maize was planted as a rotational crop to peanut and to provide local need for poultry feed. Nitrogen based fertility treatments were studied and it was shown that comparable yields could be obtained from a range of nitrogen sources available within the region.

The cottage industries were established in 7 villages initially, and set up to feed approximately 1400 students per day. The product was a peanut butter/cassava bread snack, with a glass of fruit juice. Peanut CRSP helped to supply equipment and infrastructure needs. These included peanut roasters, grinders, shellers, storage bags, building modification and maintenance, pumps, generators and other miscellaneous supplies needed for daily operations. We worked with Full Belly project to supply shellers for each village and tested a solar powered pump for its utility in the region. We have worked closely with our in-country NGO and secured funds for a new building. In 2010 this new facility was dedicated and provides a model for the most current storage, processing and preparation areas in the region. The snack program expanded in 2011 to encompass all the villages in the region (47 in total) with 6 of the original cottage industries providing the base peanut butter manufacture for the additional villages. Peanut butter is produced in bulk and transported to these outlying villages and approximately 4000 children are fed a snack each day within the region. Aflatoxin management by growers and cottage industry persons has been a major emphasis as increased aflatoxin levels have been detected since the expansion. We provided training and equipment (HPLC) for the Ministry of Health in aflatoxin detection and quantification. We also provided training and inexpensive testing materials to the regional agricultural center. In addition we provided laboratory glassware and other lab equipment and helped setup a testing facility for aflatoxin. We also developed a presentation detailing the VICAM aflatoxin testing procedure and also provided VICAM test strips. We also worked with our NGO and the Ministry of Education to develop standards and quality control specifications for the cottage industries as a protocol for detection, monitoring and management of aflatoxin. In 2012 we provided and installed a dryer at the cottage industry in Aranaputa to adequately dry samples prior to storage. A plan to provide additional dryers at other villages is highly warranted.

Significant Challenges: Challenges have included travel constraints from U.S. cooperators (not financial but time), inability to effectively communicate (due to accessibility because of local conditions) during certain times of the year, and transportation within the region to interface with more growers and regions. Our in-country NGO has provided much of the day-to-day support and the placement of a graduate student in the village during the growing season has been of great benefit. The ability to accurately evaluate and assess the impact of the cottage industries has been a struggle. In addition, the ability to measure the effectiveness of trainings is difficult.

**Table 1.** Human Capacity as a Result of Peanut CRSP Project UFL 155

<u>Name</u>	<u>Gender</u>	<u>Country</u>	<u>Degree</u>	<u>Completion</u>	<u>Training</u>
Alyssa Cho	Female	US	PhD	August 2014	US & Guyana
Abraham Fullmer	Male	US	MS	Fall 2013	US & Haiti
Marian Luis	Female	Philippines	MS	Fall 2013	US & Haiti
Imana Power	Female	Suriname	MS	Winter 2014	US, Bolivia, Guyana

In addition, we have provided extensive hands-on training to several persons in the region, including Randy Gilbert, Basdeo Singh, Jude Abraham, William Toney, Behi Banzagar, Cleophus Duncan, John Edwards, Mike and Alma Shook, Esther Isaacs, Yvette Benjamin. These are in the areas of peanut production, small business management, food processing quality and standards or other aspects of the project. Moreover, 50-60 women have received training as a result of their employment in the cottage industry over the past 7 years (see Table 2). More women continued to be trained as this program continues and expands.

**Table 2.** Workshops and Trainings as a Result of Peanut CRSP Project UFL 155

<u>Location</u>	<u>Training Type</u>	<u>U.S. or In-Country Trainers</u>	<u>*Trainings/Participants</u>
Haiti	Field production	U.S.	2/30 (20 M, 10 F)
Haiti	Field production	In-country	6/30 (20 M, 10 F)
Haiti	Aflatoxin Management	U.S.	1/20 (10 M, 10 F)
Guyana	Field Production	U.S.	1/25 (15 M, 10 F)
Guyana	Aflatoxin Management	U.S.	1/65 (15 M, 50 F)
**Guyana	Aflatoxin Management	In-country	7/18 (3 M, 15 F)
**Guyana	Business Training	In-country	7/18 (3 M, 15 F)
**Guyana	Processing, sanitation	In-country	7/18 (3 M, 15 F)
Total/year	-----	-----	32/224 (89 M, 135 F)
Grand Total	-----	-----	160/1120 (445 M, 675 F)

\*Number of trainings per year averaged from 2007-2012. M = Male participants, F = Female participants.

\*\* Routine annual training for cottage industry personnel (7 industries) conducted through in-country NGO as part of snack program agreement with Ministry of Education and Health.

### **Final Interpretation –**

**Cap Haitien, Haiti – Importance of Achievements:** The achievements are significant with respect to understanding varieties used in the region and issues impacting production. Through our in-country agronomist, Jamie Rhoads, we have evaluated several peanut varieties with substantial resistance to peanut rust. Peanut rust is a major problem for Haiti peanut farmers, and also leafspot diseases which include both early and late leafspot. We also worked with Jamie to provide small plot tractors to assist in tillage for field preparation and in-season cultivation to reduce labor inputs. Implements for this equipment were also provided. We also provided training in many phases of basic field production including planting density and row spacing, proper seed selection for planting, seedbed preparation,

fertility requirements that included soil testing, weed management, and disease recognition and management through cultural and chemical methods. Training in proper harvesting techniques, shelling and storage were also conducted.

The Medika Mamba production facility has seen tremendous improvements and operational upgrades with the support of Peanut CRSP. We have provided a peanut dryer with 1600 pound holding capacity, a 1 ton per hour 3 stage peanut sheller with sizing shaker, a splitter/blancher with aspiration and picking table, a farmer's stock cleaner with stick and sand removal as well as de-stoner, and an aspiration and picking table. Frank Nolin worked closely with Food and Meds for Kids to provide technical and manufacturing expertise in setting up and testing the equipment. We also worked with factory workers in establishing guidelines for operation, sanitation/cleaning and routine maintenance. Aflatoxin detection and management was also core to the entire operation, from purchasing quality peanuts to proper storage, cleaning, roasting, shelling, grinding and manufacture of the Medika Mamba.

The overall importance of our work is that we determined critical issues effecting peanut production in the north and central regions of Haiti, and also provided some degree of impact with respect to addressing problems; but moreover we helped Food and Meds for Kids develop a factory that produces Medika Mamba, a "Ready to Use Food", for feeding malnourished children.

Rupununi, Guyana – Importance of Achievements: The achievements in the Rupununi Region of Guyana are similar to that in Haiti, but much broader in scope. We have conducted more extensive field trials with respect to variety evaluation and varieties have been adopted by the local farmers. We have also identified several key practices that have helped improve yield and quality. Weed management has improved and several growers have begun to utilize herbicides for weed control. The production guide has been very useful for growers and in sought in high demand. The ability to have a graduate student work and live in the region during the peanut growing season has been very effective. Her research provided much of the foundation for variety evaluation in terms of yield, quality and disease resistance. She also was able to study other crops essential as rotational crops with peanut. She worked closely with our cooperators in establishing research and community farms, and conducted field days to showcase her work with local growers, cottage industry employees and school children. We also worked with Jock Brandis of Full Belly Project to introduce solar power pumps to help expand irrigation capacity.

The achievements with respect to the cottage industries and the school snack program have been tremendous. We have provided infrastructure support to 7 cottage peanut butter factories that included the installation of a new higher capacity factory in Aranaputa that serves as a showcase and training facility for the region. Full Belly Project continued to provide critical expertise in the use of the shellers for peanut in the cottage factories. We also worked closely with our in-country partner during the expansion of the school feeding program to reach all children in the region. This included additional support products – locally sourced materials, containers for peanut butter, production guides and training and support materials for aflatoxin detection, monitoring and management. We helped develop an aflatoxin management procedure that integrated persons from the cottage industry through local officials to the aflatoxin laboratory operated by the Ministry of Health in Georgetown. We also

retrofitted, provided equipment and lab supplies to establish a regional laboratory to test for aflatoxin. A training presentation has also been developed to provide a quick and easy training in the use of a straight-forward testing kit for aflatoxin.

Importance of Capacity Development: In both Guyana and Haiti, capacity development has focused on training and expanding the knowledge base of local communities in all phases of peanut production and utilization. We have conducted numerous trainings through workshops, informal meetings, field days, and one-on-one grower conversations. We have tried to introduce new techniques and technologies to improve production, and establish a value-added system that encourages growth of the industry through market expansion. This approach has worked well in Guyana and has tremendous potential in Haiti. Another important component in capacity development is the empowerment of women in the work force and the nutritional benefits gained from peanut consumption. Educational awareness surrounding food quality and health related concerns are also paramount. Physical capacity development is detailed thoroughly in the previous sections, but we provided long-lasting technical changes that we feel will be utilized for quite some time.

Heritage – Training and Publications: We have provided intensive training to select farmers on peanut production practices and these in turn have begun to train others within their villages. However, the trainings to men and mostly women associated with the cottage industries are likely to be the most long-lasting. Skills including business (accounting, basic banking, concept of credit), time management, sanitation, and health are being observed in the development of other industries throughout many communities. The production guide developed for Guyana and translated for use in Haiti is widely utilized. Printed materials outlining procedures and guidelines for peanut butter manufacture are still in use in the local factories. Presentations and guidelines for managing aflatoxin are also being used.

Benefits to U.S. – Technical Achievements and Capacity Development: The benefits to the U.S. from both the Guyana and Haiti projects have been multifaceted. Graduate student training has been fostered and supported through our Peanut CRSP project. Faculty from several U.S. institutions have benefited through knowledge gained, appreciation for a diverse clientele and development of training materials that can be used across a range of areas in the international arena. In addition, the interaction and cross-cultural exposure cannot be measured, but most certainly affects our way of thinking, teaching and training. We have gained insights into tropical production systems and gained knowledge from research conducted in country.

### **Final Summary of Accomplishments by Objective -**

*Objective 1: Primary production enhancement in the Rupununi will be addressed through a number of mechanisms.*

We conducted field trials to evaluate varieties that would improve yield and disease tolerance in the region. We found several varieties to perform equally to or greater than the local standard in terms of yield, but only a few provided great tolerance to leaf rust and leafspot diseases. The local variety, named Guyana Jumbo, was found to be very resilient and may provide valuable germplasm for breeding efforts in the U.S. Within this objective we also evaluate intercropping looking at substituting peanut

within a traditionally spaced cassava planting to determine if peanut could be successfully grown as an intercrop. Maize intercropping with peanut was also studied. Cassava had no impact of yield and grade of peanut, maize however, did impact peanut. Maize planted as a rotational crop to peanut to provide local need for poultry feed was shown to be beneficial.

*Objective 2: To address increased mechanical efficiency we will work with Full Belly Project and local fabricators to provide equipment for the cottage industries and labor-saving devices for local farmers.*

In 2008-2009 we shipped 7 Full Belly shellers to Guyana where a local fabricator assembled machines for distribution to the communities operating peanut butter factories. By the end of the project these shellers are still in operation, and several have been upgraded to operate with an electric motor. In addition, the local fabricator provided upgraded roasters to minimize burning and adapted for operation with bottled propane gas. We have introduced a portable sheller through cooperation with Frank Nolin, a local peanut equipment manufacturer in Georgia. We shipped 7 units that utilize expanded metal to manually strip the peanuts from the vine. However, these are not being fully implemented due to concerns with excessive trash and pegs remaining attached to the nuts. We also worked with Frank Nolin to introduce a small gas dryer for the Aranaputa village to assist in drying of peanuts. This piece of equipment was set up in September 2012 and there was great enthusiasm for this dryer with plans to utilize for other products.

*Objective 3: Storage facilities will be standardized for villages in the primary peanut growing areas, including those villages that currently possess a cottage industry.*

The cottage industry building at Aranaputa was completed in 2010 fully operational. This includes a 'clean' area for peanut butter manufacture, with separate areas for peanut roasting and cleaning. There is also a large storage area, built to ensure adequate ventilation to minimize spoilage. We provided the technical expertise and partial funding to complete this large-scale project. The cottage industry concept has been expanded to include 26 additional villages, and we helped provide a base level of support during the establishment of the snack program. This included training in sanitation, food preparation and processing facilities have been established at each location with oversight from S-SOS, the Ministries of Education and Health. We introduced Grain-Pro bags at all cottage industries to provide for proper storage, however these bags were not widely adaptive, hard to use and not very effective in providing insect control and deterring mold and other fungal problems.

*Objective 4: Quality parameters will focus on aflatoxin in peanut at the field, storage, and processing level.*

Aflatoxin levels during the initial phases of the project were very low, but with the expansion of the snack program and the need for more processed peanuts, a few number of samples showed level above the desired limit. We then began a series of trainings to re-emphasize the importance of detecting, limiting and the health issues with aflatoxin. We also helped to establish guidelines and protocols for managing aflatoxin in the snack program. We conducted training with the Ministry of Health personnel in March 2011 to establish guidelines and testing procedures for aflatoxin in peanut. This meeting also included personnel from the National Agricultural Research Institute and a VSO food safety volunteer



stationed in the region. The program was conducted by Dr. David Wilson from the University of Georgia. The workshop covered 2 days and included the problems associated with aflatoxin, the causes of the toxin, including fungal (*Aspergillus flavus*) biology and detection methodology. The persons at the Ministry of Health were trained on how to properly prepare samples, calibrate and operate the detection instrument, and properly assess and record aflatoxin levels. A protocol was established for sampling peanuts at each peanut butter factory, transport to lab facilities in Georgetown and reporting of results back to the proper persons in S-SOS. We established a regionally based testing facility that utilizes the Vicam test kits in St. Ignasius. We provided the necessary laboratory supplies including glassware, small digital scale, filters, etc. to help set up a lab and help train in the use of the kit. We also developed a presentation on how to use the kit.

*Objective 6: This objective assessed the social implications of increased peanut production and the associated processing industries in certain villages.*

We have completed quantitative assessments of cottage industry sales and economic status through our partnership with S-SOS in Guyana. The results of the surveys addressed key points in the function of the cottage industry - especially as it relates to personnel management, book keeping, record keeping and budgets. This provided the framework for future trainings in these areas conducted in subsequent years. As a result of the training and these initial surveys, the industries are making money. In addition, in Aranaputa, over 50% of the sales of peanut butter are to local individuals and not the school snack program. Large surveys were conducted in March and June of 2010 to measure the impact of the cottage industry and changes in peanut production. Surveys were conducted in villages with a history of the peanut butter snack program and in those without the program yet. Several additional assessments were planned but a lack of personnel and transportation issues have prevented any formal surveys. Alyssa Cho conducted several surveys in the region in 2011 and 2012, and contracted with a local woman to perform additional surveys. This is in the process of being analyzed as a component of her doctoral research, along with local economic data to assess the overall impact of the cottage industry concept.

*Objective 7: Slash and burn continues to be a common practice in the south Rupununi region. The objective was to better understand the ecological dynamics of deforestation, peanut production and subsequent forest recovery.*

We were not able to conduct any research in this area due to logistics of travel and personnel. In addition, many farmers in the south Rupununi region have found more profitable employment in Brazil or in local logging or mining operations. As such, fewer peanuts are being produced in the traditional slash and burn system.

*Objective 8: This objective is the over-arching for objectives 1 through 6. It satisfies those objectives detailed for the Rupununi region of Guyana. The purpose of this objective is to provide a cumulative cost assessment for this region.*

Much of this objective is addressed in previous objectives. Overall economic data is being analyzed and will be a dissertation component of Alyssa Cho's doctoral research.

Objective 9: *This objective will address primary peanut production issues in Haiti.*

We established several on farm trials in Haiti to address basic agronomic issues, including fertility, adaptable cultivars and disease management. We also conducted several trainings on several phases of peanut production and distributed peanut production guides in Creole and held several production workshops for growers in Haiti. We are working closely with Food and Meds for Kids to provide training on aflatoxin detection and management. We have also addressed these issues with growers. We hired a local agronomist to address and help train in areas of peanut production. Food and Meds for Kids is our in-country partner and their peanut butter factory continues to have major issues with aflatoxin, so much so that many peanuts cannot be sold to the local orphanage. In later field research, we assessed varieties for disease resistance, yield and quality. We continue to provide a large focus with respect to aflatoxin, mainly through proper storage techniques and training. We also provided assistance with the processing facility - including equipment, testing and technical assistance.