Peanut Collaborative Research Support Program (PCRSP)

Cochabamba, Bolivia

An Introduction to Peanut CRSP

The Peanut Collaborative Research Support Program (PCRSP) is funded by USAID and fosters collaboration between US universities and partners in developing countries through applied research projects.

Using a peanut development platform, PCRSP works with over 10 US universities around the world in areas such as peanut production and processing, health, nutrition, market development, gender, biodiversity, technology, international research, capacity development, and mycotoxins.

Peanut CRSP is housed within the University of Georgia and is located on the Griffin Campus. To contact PCRSP:

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PCRSP is one of ten CRSPs, each of which has a specific platform for development. The CRSPs form a unique and extensive network of research universities.

Peanut CRSP Resources

Assistance with Farmer Workshops

- AF detection and management
- Improved production techniques
- Product testing and market creation

Aflatoxin Management

- AF lab capacity building
- Testing for AF biomarkers
- Testing for AF in food
- Management of AF

Peanut CRSP projects fall into three sectors of the value chain:

- **Production**
- **Processing**
- **Consumers**

- Policy change and implementation
- Training in AF removal
- AF Workshop and Seminar (with Key AF experts)

Other

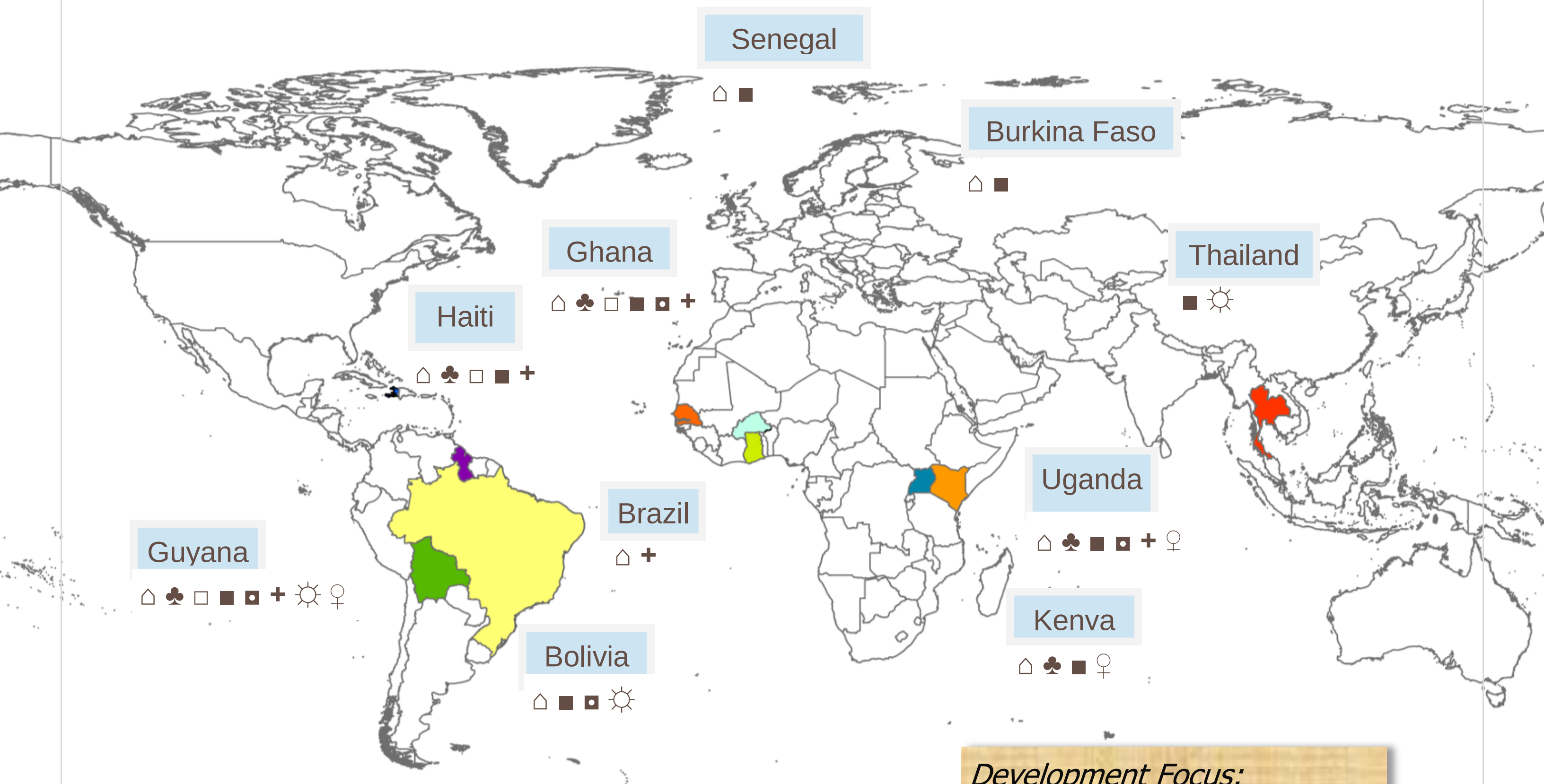
- Technology
- Capacity and Institution Development
- Policy Analysis
- Outreach

Figure 1: Santa Cruz, Bolivia. ANAPO research site.

Peanut CRSP Projects

The Peanut Collaborative Research Support Program (Peanut CRSP) is one of 10 CRSPs funded by USAID to support research between US universities and developing country partners. Since its inception in 1982, Peanut CRSP has currently projects in over 3 continents, with more than 40 international partners, including 10 US universities, and serving many developing communities.

Projects are interdisciplinary in areas like agriculture, economics, food science, sociology, plant pathology, environment, genetics, public policy, health, gender, and marketing.



Peanut CRSP US universities include:

- University of Georgia
- University of Florida
- University of Connecticut
- Cornell University
- Oklahoma State University
- Virginia Polytechnic Institute and State University
- Texas Tech
- North Carolina State
- Texas A&M
- University of Alabama Birmingham
- Auburn University
- Purdue University
- New Mexico State University

Development Focus:

⌂ Capacity Building
♣ Mycotoxins
\+ Nutrition/Health
□ Processing Technology
■ Production Technology
◘ Market Development
☼ Biodiversity
♀ Gender

Peanut Production Technology

PCRSP has over 20 years of success in increasing peanut production for farmers around the world. In most projects, increasing production is a problem that is often considered isolated from market demand. An increase in production should be considered part of a comprehensive project where the creation of new markets and demand is taken into account. Improving production is a part of our primary mission and we are collaborating with ANAPO to develop improved varieties and technologies.

PCRSP with USDA, the University of Georgia, and the University of Florida have been working with ANAPO to create and identify new cultivars both resistant to rush and leaf spot. Several graduate students are employed by this project and personnel from ANAPO have gained research experience with faculty at the institutes mentioned above. ANAPO continues to build capacity within Bolivia to become leaders in genetic breeding programs to benefit both the country and region.

Figure 2: ANAPO green house with students in training.

Value-added Products

Peanut CRSP has extensive successful experience in increasing production for peanuts. Several of the projects work on improving peanut yields in various types of climates and environmental conditions. PCRSP researchers can identify the resources needed to achive improved yields. Often this includes changes in technology (either through provision and testing of improved varieties and inputs), provision of training, or suggestions for different management techniques to expand, augment and magnify productivity.

Figure 3: Guyana children eating school peanut snack.

With increased yields, often comes a need for increased demand. PCRSP has worked with several communities in identifying new markets, creating/testing new products, and increasing income-generating opportunities for women. PCRSP experts include scientists with processing/packaging expertise, food testing, and socioeconomic analysis.

Examples of PCRSP projects include:

1. New foods products for individuals with compromised immune systems through advanced computer models and software. Special populations with specific nutritional needs (malnourished children, pregnant women) can have products tailored to them using local ingredients. This model is being implemented in the creation of Ready to Use Therapeutic Foods (RUTFS) for communities in Ghana and Uganda.

2. PCRSP researchers have expertise in the testing of new products, identification of new markets, and in the creation of processing capacity. Early PCRSP projects in the Philippines helped one peanut entrepreneur convert her home kitchen peanut product into a large scale production company, with her products found in national super markets.

3. Another PCRSP project, the Guyana School Snack program, uses local ingredients to create healthy snacks for school children providing women with employment, creating a market for local peanuts, and improving children's health/educational productivity.

Figure 4: peanut butter product-a new secondary market.

Specifically PCRSP can:

- ☐ Help identify production problems and provide solutions through technology changes, capacity building and other
- ☐ Test new products for the market

- ☐ Support the creation of new markets for existing products or newly available products
- ☐ Increase income-generating opportunities for women

Aflatoxin and Other Mycotoxins

All major nutrition-based disease burdens in developing countries, with the exception of iodine, are modulated by aflatoxin (AF). The PCRSP has an extensive program addressing AF, which contaminates many foods like corn and peanuts. Exposure to AF is particularly harmful for children, and PCRSP researchers have shown in African children linear relationships between levels of AF exposure and childhood stunting, underweight, and vitamin E status.

Figure 5: Bolivian peanuts.

AF exposure has been found to be related to HIV incidence, promoting infectious disease including TB and malaria. A large percentage of AF studies have been linked AF exposure rates to liver cancer. Only recently has research, much of which has come from PCRSP scholars, begun to unravel the complex problem of AF exposure and its effects on human tissue/systems. Non-infectious disease, like cancer, is only one of the many effects, and it is likely the impact of AF on infectious disease rates from immune compromise is creating a much larger public health crisis.

Testing for Aflatoxin

Usually the first step in AF management is to identify the levels and locations of exposure. The number one determinant of a good AF reading is the quality of the sampling procedure.

PCRSP works using the following:

- ☐ **Urine**
  - Aflatoxin M-1 (reflects exposure in the last 24-48 hours, each kit costs typically about $10.00 a kit, measures both quantity and presence/absence, measured with HPLC and requires lab and experts)
  - Other kits (measure just the presence/absence of AF, ELISA-based)
- ☐ **Blood**
  - Measures chronic exposure through measurements in Albumin-aduct and each test costs about $50.00, requires separation of the blood into serum and preservation of serum at -80°C, this is available only in three labs around the world including a PCRSP lab at the University of Georgia.
- ☐ **Food**

- Infrared reflectance: newest technology not even on the market. The advantage of this is rapid results (1minute), requires no solvents/reagents (low operating costs), and it can be portable. The machine measures through infrared AF pre-cursers (presence of biochemical characteristics prior to the presence of AF).

- HPLC: this is the standard analytical method requiring solvents, and commonly used by most laboratories including those in PCRSP projects.

- ELISA: is the economical version of AF testing but not as precise and reliable as HPLC and infrared reflectance.

- Thin Layer Chromatography: this is the old technology, tends to be very slow and has high solvent costs.

Biomarkers for AF are more reliable than food levels since consumption rates vary and individuals do not always track their food well through surveys. Urine and blood testing offers a more accurate assessment of AF exposure levels.

Testing for AF in populations can lead to misleading results if only foods are tested. Thus, PCRSP research works in finding the most advanced technologies to test the presence of AF in food, as well as in people. Often times contaminated food is consumed by the poorest population, due to food scarcity. In many countries where PCRSP has conducted research data shows exposure rates to be high for all levels of populations.

Managing Aflatoxin

Contamination can occur at all stages of harvest. The majority of the toxin is produced in post-harvest stage especially in maize and peanuts. Most countries globally are unaware of the effects of AF on their population. Only a few have begun to tackle AF and they often struggle with creating a management strategy to address this toxin. PCRSP has proposed various options at various stages:

- **Pre-harvest:** contamination during this stage is best prevented by an integrated management approach:

    - Sowing varieties which are resistant to contamination, or which (by virtue of maturity) escape the major risk of moisture stress when the rains end prematurely. The majority of pre-harvest contamination happens when the plants are droughted over the last 4 weeks of the season; under these conditions varieties of peanut differ in their resistance to the fungus.

    - Irrigation is very effective at limiting aflatoxin because the fungus is most active and competitive when plant tissue or meat is half dry. Fully dry and well watered plants minimize the growth of fungus and thereby avoid the toxin.

    - Integrate pest management is important to prevent invasion by the fungus. Both maize ears and peanut pods damaged by insects and birds during crop growth are more prone to contamination by AF. It is important to know other important toxins can also be promoted by this damage. Fumonisin which is associated with throat cancers, and probably enhances HIV transmission, is a particularly important risk in maize.

- In the case of maize the size of the ear is important since ears that are heavy enough to point downwards do not get much water into the end if rains happen after maturity. Thus, insect damage to the stem (stalk borers), excessive plant populations, and low fertility all increase the risk of contamination.

- Emerging technologies to manage pre-harvest contamination may become available. Presently being tested in in the field in Nigeria and Kenya is an experimental method that reduces the number toxin producing fungi.

- **Harvest:**

  - Aflatoxin is mostly produced between the moisture contents of 12% and 20% (in partially dry foods) and when the temperatures are between 20°C and 35°C.

  - The important aspects of harvest to limit aflatoxin are to get the grain dry (<12%) as fast as is possible, and to avoid rewetting through rains on the crop. In developing countries, solar and passive air drying is the most common way this is achieved, but r eflecting the importance of rapid and full drying peanuts and maize in America are commonly dried with heated air.

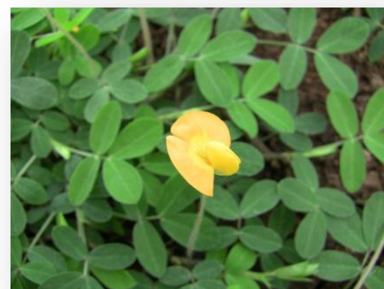


Figure 6: Bolivian peanut plant.

  - In peanut harvesting rapid drying is usually best achieved by turning the plants upside-down so the pods are exposed to the sun and air, and if there is any rain this is able to run off the pods. However, where rain is a regular feature of the harvest environment, then other approaches can be used. Early peanut production in the USA used stack-poles in which the plants with their pods are held off the ground until they are dry enough to be threshed.

  - For maize there is always the option of opening the husk to expose the grains - but this also exposes the grains to other agents of loss (insects and birds), and to rain if that is a risk between the dehusking and harvesting. Commonly people spread pods or corn ears on the ground to dry - this practice increases the risk of aflatoxin since the spores of the fungus come from the soil.

  - A recent innovation in protection against adverse weather during the drying phase is the use of a 'Drying purse'. This is a large relatively thick sheet of plastic with a water tight zip that seals one half to the other half. The sheet is spread on the ground and a layer of grain is spread out to dry in the sun. At night or when there is rain the top 'cover' is pulled over the grain and it is zipped close to prevent rewetting (at night dew can rehydrate the grain, delaying the drying process). This approach is good for both peanut and maize - maize dried like this is better either dehusked or threshed.

- **Post-harvest:**
    - Once the pods and grain have been secured and dried the next action is to ensure that they stay dry. Choice of storage is important- it is important the storage building/containers preserve the moisture content at a safe level, and steps are taken to ensure insect damage is prevented. A common source of moisture is condensation from metal roofs. The other important consideration is the management of insects during storage. Insects respire and add moisture to the grain; pockets of insect damage commonly result in pockets of aflatoxin.
    - Two possible storage options exist and both are very different.
        - One option is to store the produce in ventilated stores, with pallets under the bags of grain to allow air movement and ensure any moisture present does not concentrate in a locality. This requires the grain is fumigated at intervals.
        - The other solution is to get the grain dry and then seal it into an airtight container. Seeds use the oxygen in the container and once that is depleted the fungus that produces the toxin stops growing and no further toxin is produced. This can also be achieved by removing the oxygen in an air-tight granary by processes that consume the oxygen – a candle or other chemical means to remove oxygen can be used.

Decontamination of Aflatoxin

Once the food is contaminated with AF, few alternatives currently exist in treating contaminated food.

1. **Discard contaminated food:** this option is often not viable since food is usually scarce where AF is problematic. Often contaminated food is consumed by the poorest populations or given as feed to livestock. In both cases, AF is very harmful.

2. **Clay:** recent PCRSP work has found a special clay capable in binding AF in the food. This option is not only economical it is also safe and easy to apply. The food is left safe for both human and livestock consumption. In the US, clay has been used in the livestock industry and PCRSP studies are undergoing human trials to show its efficacy and consumption safety.

Figure 7: Senegalese women sorting peanuts.

3. **Alternative use:** a few options still under research and development are being considered for the use of contaminated AF food as a source of fuel or made into other products.

For a complete list of AF articles, from the various PCRSP projects, please visit the website http://peanutcrsp.org.