



Bulletin of Tropical Legumes

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About the bulletin

The Bulletin of Tropical Legumes is a quarterly publication of the Tropical Legumes III (TL III) project, funded by the Bill & Melinda Gates Foundation, and jointly implemented by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the International Center for Tropical Agriculture (CIAT) and the International Institute of Tropical Agriculture (IITA) in close collaboration with partners in the National Agricultural Research Systems of target countries in sub-Saharan Africa and South Asia. TL III aims to improve the livelihoods of smallholder farmers in drought-prone areas of the two regions through enhanced productivity and production of grain legumes.

Groundnut is an important oil, food, and feed legume crop grown in over 100 countries covering 25.44 million ha worldwide with a total production of 45.22 million tons in 2013. India and Tanzania are the world's second and sixth largest producer, respectively. Tanzania saw the greatest jump in groundnut production from less than 340,770 metric tons in 2008 to 810,000 (more than double) by 2012 <http://www.factfish.com/statistic-country/tanzania/peanuts,+production+quantity> and FAOSTAT 2014. This resulted from rapid increase in area and yield, availability of new highly productive varieties from research, support of integrated seed systems development and promotion of good agronomic practices. This issue highlights new variety technologies developed and promoted by the TL III Project in Tanzania and India.

New groundnut variety promises improved livelihood for smallholder farming group in Mpeta village Masasi District, Tanzania

Southern Tanzania is a rich fertile region that unfortunately suffers the dire consequences of poor rural development. As part of an initiative to improve the economic welfare and general food productivity of the region, Tanzania's Naliendele

Research Institute (NARI) under the Department of Research and Development (DRD) began a series of research projects directed at a small group of willing farmers, eager to change their fortunes. Naliendele Research Institute is located in the Southern Zone in Tanzania and it works in a unique environment. NARI is one of the partner's in the ongoing Tropical Legumes III Project on improving the livelihoods of smallholder farmers in drought-prone areas of sub-Saharan Africa and South Asia through enhanced grain legume production and productivity. The focus in the region is on groundnut farming with support from the Bill & Melinda Gates foundation (BMGF).

In 1994, the Mapambano Farmer Research Group was formed comprising 7 members, 4 male and 3 female, led by the Issa Kwayaya brothers, Hassim and Kassim. The objective of the Mapambano group was to fight poverty – Mapambano is derived from Swahili meaning to “fight”.

The members of the group were individually involved in groundnut farming and they used their traditional variety known as *Kanyomwa* or commonly referred to as *tatu tatu*; this is due to the fact that each pod has three kernels. The researchers came on board to enhance their interest and thus their pursuit of improved groundnut farming.

The group was successful in recruiting willing farmers at first; growing to 40 members by the year 2000. Unfortunately the nature of the research was too demanding for some of the farmers, and the number of members has since reduced to 18 because the other farmers could not keep up with the momentum of the founding members. According to Hassim Issa Kwayaya, the chairman of the group, “Groundnut farming is labor intensive and most of the members could not cope with it, thus the reduction in membership”.

Nevertheless, the Mapambano group were key participants in the research initiative. They were to test 4 varieties, Nyota, Johari, Sawia and Pendo with local variety called “Nachingwea” (also known as Red Mwitunde, an old variety that came from Nachingwea Groundnut Scheme). As a priority variety the team selected Pendo, the variety that was released in 1998. The variety produces high yield, bold seeds, takes a short time to mature and is highly marketable. The group has also identified a new variety which they have called “Mpeta”, which is a variety yet to be released.

According to Mr Kwayaya the characteristics of “Mpeta” seed variety include a resistance to pests, diseases and drought.

Project:
Tropical Legumes III
(TL III)

This work has
been undertaken
as part of the



RESEARCH
PROGRAM ON
Grain Legumes

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Bill & Melinda
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Figure 1. The Issa Kwayaya brothers, Kassim (Right) and Hassim (left), Chairman and Secretary of the Mapambano group in Mpeta village, Masasi district.

In the beginning, Mapambano group had allocated just one acre of land to seed production but now they have 8 acres. Whereas before they had hired the land, they have now purchased the land they use for seed production. In addition, each member has between 6-18 acres of private land, which they use for groundnut production at individual level.

The progress of the group has been steady; the initial harvest was about 10-15 (50 kg) bags of groundnut pods per acre and their production has grown to between 20-25 bags per acre. "In a good season when the weather is conducive, some members have reported harvesting 30 bags per acre of groundnut", said Kassim, the secretary and founding member of the group.

Most group members had mud huts and through the use of their proceeds they now have modern houses with corrugated iron sheets. They have also adopted new tools, changing from using manual labor and hoes



Figure 2. The structure that Mr Kassim keeps his cows and goats in, which is part of the investment from groundnut farming proceeds.



Figure 3. Mr Kassim with the bicycle he bought from the proceeds of groundnut farming at Mpeta village, Masasi District.

for land preparation and tilling to usage of tractors, which they hire.

Currently Mapambano group's average harvest has been between 150-200 bags of groundnuts per season from their 8 acres. In 2014, Mapambano group produced 300 bags of groundnuts, their largest harvest to date.

The financial successes have led the group to join Nufaika SACCOs, a financial institution from which they

hope to acquire business loans that will help them fulfill their dream of expansion. They plan to utilize their profits to acquire their own tractor by 2016.

According to Charles Mkandawire, Principal Agricultural Field Officer with Naliendeke Research Institute, "The members of the group have actively participated in the training that our team has been offering. This is one group that has actively implemented the training we have provided".

Hassim further pointed out that members have not only benefited with education in farming but also reported that members have been able to pay school fees for their children, able to afford better health care, and acquire more land for farming activities. The members of the group have also used the returns from farming in buying chicken, goats and cows. Figures 1-5 show the different aspects of the Mapambano group.

TL II in South Asia bears fruit – a new groundnut variety for Tamil Nadu

In South Asia, the Tropical Legumes project is being implemented in Bangladesh and India.

During phase II, in Bangladesh, a total of 131 participatory varietal selection (PVS) trials were conducted in nine districts. Two short duration high yielding varieties, BARI Chinabadam-8 and BINA Chinabadam 4, were identified, which will be replacing an obsolete groundnut variety, Dhaka 1. New crosses involving nine parental lines were developed and breeding populations (F_2 to F_5) were evaluated and promising selections made. Seventy two lines previously obtained from ICRISAT, India were evaluated and superior lines were selected for early maturity and high yield. To disseminate and popularize groundnut varieties and technologies, 870 farmers were trained, 2 field days were conducted, with the participation of 130 farmers. Two television programs were broadcasted. As part of capacity building, seven scientists were trained on various aspects of groundnut breeding and production, including integrated molecular breeding.

In India, in phase I, Karnataka and Tamil Nadu were included, while in phase II, Bihar and Odisha were added. Through PVS and paired comparisons trials conducted over a number of years, a number of promising groundnut varieties were identified in each state. The farmers' preferred varieties in Bihar included ICGV 02266 and ICGV 91114 in Araria and Purnea districts and ICGV 93648, ICGV 89280 and ICGV 91114 in Jehanabad and Nawada districts. The farmers in Araria also preferred DH 86 for spring season cultivation. ICGV 91114, GPBD 4, ICGV 00350, Chintamani-2, and R2001-2 in Karnataka and ICGV 91114 and ICGV 02266 in Odisha (Figure 4) have been identified as most promising

varieties by the farmers. In Tamil Nadu, ICGV 87846 (CO 6) and ICGV 00351 (CO 7) have been released for cultivation. The former belongs to Virginia bunch while the latter is a Spanish bunch type.

CTMG 6, CTMG 7 and DH 236 in Karnataka, ICGV 02266, 07220, 04623, 07213, and 10004 in Odisha, and ICGV 01263, 96155, 02266, 03128, 06146, 07018 and COG 0402 in Tamil Nadu performed very well in multilocation trials. These will be entered in states/national trials for testing and possible release. UAS Dharwad and UAS Bangalore, respectively, identified 10 and 24 varieties from international trials. TNAU identified seven varieties either with resistance to drought or high oil types.

To support breeding programs, ICRISAT made over 900 crosses and provided project partners 192 sets of international trials, 449 advanced lines and 236 trait-specific breeding populations. Likewise, the participating centers also generated their own breeding populations and made large number of single plant selections or bulks for further evaluations. At some centers, new facilities were established to support breeding activities. A manually operated rainout shelter for phenotyping drought tolerance, equipment for measuring drought tolerance, and sprinkler irrigation systems for screening for resistance to foliar diseases were established at some centers in Karnataka and Tamil Nadu.

Under capacity development, six students (three each PhD and MSc) have successfully completed their research and submitted their thesis under the project. A total of 10 scientists/technicians received hands-on training on breeding and production technologies, screening for virus diseases, data management and statistical modules, and on integrated molecular breeding. Five seed entrepreneurs also received skill development training on seed production and seed

business skills. A number of pamphlets/leaflets in the vernacular language describing the characteristics of improved varieties, improved package of practices for groundnut, tips to produce quality seeds in groundnuts, techniques to overcome loss of seed viability in *rabi*-summer groundnut, integrated crop management practices in groundnut, improved cultivation practices for enhancing groundnut production under rainfed, integrated pest and diseases management, etc, were widely distributed to over 40,000 farmers.



Figure 4. ICGV 91114 seed production in Dhenkanal district, Odisha in 2013-14.

Mikindani Women Food Processing Group involved in empowering the smallholder farmers in Mtwara region, Tanzania

In 2006, Ms. Mariam H Mwalimu, got together with a few of her friends and formed the Mikindani Food Processing group. It was an initiative that intended to address the extreme poverty group members were enduring and the hope was to improve the livelihood of the members. Mikindani was the first group of its kind, with all the members being women.

As part of their core business, Mikindani Group processes cassava flour and makes peanut butter and mango juice. At first the group sold their products door to door in the rural area where they come from.

Though they process and sell food products as their core business, Mikindani Group also trains farmers on managing aflatoxin. They received their initial training on innovative ways to manage aflatoxin from scientists of the Naliendele Research Institute.

“The group has been among the various initiatives that Naliendele Research Institute is pursuing in educating farmers on how to manage aflatoxin among the groundnut farmers,” said Dr Omari Mponda, Breeder with Naliendele Research Institute and Country coordinator of the Tropical Legumes III project groundnut component.

Mikindani group also trains some of their clients on the dangers of aflatoxin, which is a problem to many groundnut farmers in the area.

As part of their continuous training, they attend several capacity building sessions. Mikindani Group has received training from the Small Industries Development Organization (SIDO) and United Nations Industrial Development Organization (UNIDO) on value addition to their product range.



Figure 5. The Mikindani Women's Food Processing Group, Mtwara Tanzania.

The group members work together as a team, preparing their products in one central location. Each member, however, has her own little store where she sells her products, and the group has one main store where clients can buy their products. Together, they sell approximately 100 bottles of peanut butter each month.

Their growing success means that they have now set aside a plot of land that they intend to use as a market place for their products. In addition, they participate in International Trade Fairs to showcase their products.

These hardworking women have ambitious long term plans. They plan to play a key role in awareness creation so that farmers are able to produce safe groundnuts and control the aflatoxin menace. They intend to work in tandem with Naliendele Research Institute to achieve this and educate the sellers in the market centers.

As traders, they are well placed to demand specific standards from the producers of groundnut, which in some areas require groundnut produce to be graded thereby creating uniformity of the processed product. Traders are willing to pay for quality, clean groundnut produced by farmers.

Some of the challenges that the group face include the fact that groundnut production is labor intensive so they are unable to buy the harvest in bulk. Also the peanut butter only lasts on the shelf for 2 months and so the stock does not last for long. Group members lack modern storage facilities to enable them store the produce for a longer period.



Figure 6. Ms Mwalimu explaining to Juma Mfaume, a researcher from NARI about her income generating activities involving groundnuts.



Figure 7. Ms Mwalimu (left), Mr Mchana and Dr Mponda showcase the processed cashewnut that Mikindani group stocks and sells.

Despite this, Mikindani Group has managed to achieve tremendous successes. They are now more independent and they share out the profits and save some of their revenue. So far they have been able to purchase land, processing equipment and individuals have purchased motorbikes, making

their work of selling door to door much easier. Furthermore, they are able to improve their families' lives by paying for school fees and are now credit worthy so that they can take loans.

Mikindani women's group also seeks to pass on their success to other women, so they are now mentoring more women, 7 young ladies and 3 older women. Though these mentees are not members of the group, their lives have been transformed through the training they have received.

"We can't quit being a group, we have known each other and we know what being together can do. Our lives are better now as a result of our collective effort," concluded Mariam when asked if at some stage they would think of parting ways or dissolving the group. Figures 5–7 show the Mikindani Processing Group chairperson with Naliendele researchers and some of the products the group is producing.

ICGV 00351 (CO 7), a drought tolerant farmer-preferred groundnut variety released for Tamil Nadu, India

Groundnut is a major oil and food legume crop of India grown in 4.90 million ha, with a total production of 5.77 million tons, and an average productivity of 1179 kg ha⁻¹. India is the second largest producer of groundnut in the world after China. About 90% of the groundnut in India is produced in states of Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka and Maharashtra. Tamil Nadu is one of the leading groundnut producing states (area 0.385 million ha, production 1.061 million tons, productivity 2751 kg ha⁻¹). Groundnut is a major oilseed crop in Tamil Nadu with >85% of area and >95% of production under oilseeds. It is mainly grown as rainfed crop during *kharif* season (June–September), which accounts for 70% of total groundnut acreage in Tamil Nadu.

Though groundnut productivity in Tamil Nadu is highest in the country, the fluctuations in yield over the years are observed due to changes in rainfall pattern and long dry spells during the crop growth period. Droughts of various intensity and duration commonly occur, limiting groundnut productivity. Identifying drought tolerant varieties is the best and cost effective solution to counter the uncertainty of monsoon and shrinking availability of irrigation water in the state. Breeding cultivars with superior yield performance under water limited conditions based on selection for yield under stress conditions has remained an empirical approach. Farmers' Participatory Varietal Selection (FPVS) is a novel approach in identifying farmer-preferred varieties adapted to drought prone areas. The Tropical Legumes II (TL II) project sponsored by the Bill & Melinda Gates

Foundation was implemented by ICRISAT and TNAU in Erode and Thiruvannamalai, the two leading groundnut producing districts of Tamil Nadu.

Erode district in the western zone of Tamil Nadu receives less rainfall during the cropping season (229.8 mm of total annual rainfall of 702.9 mm), which is not adequate to meet the normal growth and development of the crop. Though Thiruvannamalai district in the north eastern zone of the state receives fairly good amount of rainfall during the season (466 mm of total annual rainfall of 1031 mm), distribution is often erratic leading to prolonged moisture stress during critical growth period causing a significant reduction in the yield. Local Spanish bunch varieties and landraces grown in these regions are highly adapted and drought tolerant but are poor yielders and susceptible to foliar diseases. To improve the economic status of the small and resource poor marginal farmers, the Tropical Legumes II project was implemented in Erode and Thiruvannamalai districts to identify high yielding, drought tolerant, and foliar disease resistant Spanish bunch groundnut variety through FPVS.

The project was successful in identifying a drought tolerant Spanish bunch groundnut variety ICGV 00351 through FPVS.

High yield groundnut variety ICGV 00351 identified through FPVS

As part of the TL II project, seven Spanish bunch groundnut varieties were evaluated along with controls (VRI 6 and TMV 13) under FPVS/paired comparison trials during 2008 to 2013 crop seasons. The trials were

laid out in the farmers' fields in Erode (731 trials, 2008 to 2013) and Thiruvannamalai (720 trials, 2009 to 2013) under rainfed conditions with normal package of practice. Among the seven varieties evaluated, ICGV 00351 was found superior with high and consistent pod yield, drought tolerance and moderate resistance to rust and late leaf spot. Its remarkable ability to withstand drought during post flowering phase was much appreciated by the farmers. Bold and plump kernels with tan colored testa are an added advantage leading to increased preference by the traders and fetching premium price for the produce.



Figure 8. On-farm multiplication of seed of the new groundnut variety CO 7 with farmers in Tamil Nadu India.

ICGV 00351 is a medium duration groundnut variety (105-110 days) developed at ICRISAT, Patancheru from the cross ICGV 87290 x ICGV 87846. FPVS trials/ paired comparisons in Erode (731 trials, 2008 to 2013) showed that ICGV 00351 produced on average 30.3% greater pod yield (1,746 kg ha⁻¹) over TMV 13 (1,340 kg ha⁻¹), while in Thiruvannamalai district (720 trials, 2009 to 2013), it produced 19.8% greater pod yield over TMV 13 (1,587 kg ha⁻¹). The characteristics of the groundnut culture ICGV 00351 is shown in Table 1 (also see Figure 8).

Initiatives for enhancing adoption of ICGV 00351

Groundnut is a high volume seed crop and requires a well planned and organized seed multiplication program to meet the farmers' demands. To saturate the region with CO 7, 100 farmers identified from each of the target districts were provided with 10 kg of seed pods to produce 100 kg every season so as to distribute 10

Table 1. Pod and kernel characters of groundnut variety ICGV 00351 (CO 7).

| Characters | ICGV 00351 | VRI Gn 6 (c) | TMV Gn 13(c) |
|-------------------------------|------------|--------------|--------------|
| 100 pod weight (g) | 112 | 90 | 82 |
| Shelling (%) | 71 | 69 | 67 |
| 100-kernel weight (g) | 42 | 35 | 34 |
| Sound mature kernel (SMK) (%) | 83 | 81 | 82 |
| Oil content (%) | 51.0 | 49.5 | 50.0 |
| Protein content (%) | 22.0 | 22.5 | 21.5 |

Source: Vindhiyavarman P et al. (2014)

kg of seed pods to 10 farmers each for the next season. In addition, informal seed production activities were initiated by training 2,000 farmers identified from 20 groundnut growing districts of the state by providing technical manual and seeds of this variety. To date, 3,000 farmers have been brought under the varietal coverage and efforts are underway to cover the entire state in the next 2-3 seasons. The impact created by this variety in terms of its acceptance by the farmers and rapid spread in the drought prone districts of Tamil Nadu is an indication of how the TL II has been helpful to the resource poor marginal farmers in Tamil Nadu.

Reference

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