N2Africa Project Collaboration
Annual Report, 2012

Introduction

Soybean production in Ghana is relatively new. It is a cash crop produced predominantly by smallholder farmers in North Ghana. Estimated achievable yield for soybean is 1.5 metric ton per hectare (Source: MoFA). However, actual yields are 0.8mt/ha to 1 MT/ha. USAID/Ghana's Feed the Future agricultural value chain development project, ADVANCE, collaborated with IITA/N2Africa project for a second year to work with farmers on improving their access to, and use of, new technologies, in particularly soybean inoculant.

During 2012 the ADVANCE project built on the 2011 season trials, to increase geographical coverage, number of farmers, and had a more focused distribution and dissemination with the SARI/N2Africa team. Of the Distribution and dissemination of the inoculants technology, it was carried out with active involvement of private sector actors. This private sector led strategy is aimed at ensuring sustainable use of the technology. It is therefore interesting reporting that interest in N2Africa activities among soybean farmers and input dealers across 17 Districts in the three regions of the north where demonstrations were conducted is increasing. Worth noting, is that commercial use of the product is equally gaining momentum among farmers and input dealers. 627 packs (200gms) with the facilitation of ADVANCE were sold to farmers through input dealers.

This report captures activities carried out in the 2012 production season and in accordance with the MoU between ADVANCE and IITA. Below are the activities that were successfully implemented under the collaborative arrangements with the N2Africa Project.

Participate in IITA annual review/planning meeting - ADVANCE participated in two separate one-day review and planning meetings facilitated by N2Africa Ghana team at SARI, Nyankpala (February,2012) and Modern City (April,2012), Tamale. The review meeting purposely looked at the successes and challenges of partners in the implementation of the project activities for the 2011 farming season. The planning meeting on the other hand, focused on the issues of the target -number of demonstrations and farmers per crop per partner and their implementation strategies. ADVANCE agreed to conduct 40 soybean demonstrations to reach out to 1,200 lead and associate farmers. ADVANCE adopted a private sector led approach where Nucleus Farmers and agricultural input firms assumed roles establishing the demos and for them to own that process. ADVANCE through its existing project actors (beneficiaries) then identified 40 sites (20 NR, 10 UER & 10UWR), 40 nucleus farmers and 1,160 out-growers (Smallholder/ Associate farmers). As the season got underway a total of 28 of the targeted 40 were set up (NR=15, UER=6 and UWR=7).

Capacity Building on Inoculant Technology for ADVANCE staff and Actors - At a one-day workshop organized by ADVANCE and facilitated by Dr. Benjamin Ahiabor and Edwin, SARI-N2Africa staff, 21 (M=20, F=1) ADVANCE staff and their actors knowledge were refreshed on

inoculants handling and application. Eight new NFs/Lead farmers attended the training for the first time. This training became the foundation module upon which field level trainings were conducted for the smallholder farmers known as the associate farmers at each of the sites. These field level trainings were facilitated by the NFs and input dealers with technical support from ADVANCE staff. In total, 696 beneficiaries (692 farmers and 4 input dealers) capacities were built in the inoculants technology during the 2012 production season. The trainings increased awareness and knowledge of use among farming households.

Demo Inputs and distribution - Input firms, ADVANCE works with, donated products for the demonstration sites; as a promotional and outreach tool for the product, a method to get to know the farmers, and for the farmers to get to know the input firms. The only input supplied by N2Africa project was the inoculant, through a source in the UK called Legumefix. Contributing input companies included:

- Herbicides from Makhteshim Agan, Lious Dreyfus, CANDEL, Simple Prince, and Chemico companies.
- Fertilizer from Yara Ghana Ltd supplied the YaraLegume fertilizer for demonstration in the Northern and Upper East regions.
- Fertilizer from Chemico supplied TSP fertilizer for UWR.
- Seed from Heritage Seeds (N/R), Baba Kumasi (UER) and Antika (UWR) companies
- ADVANCE project procured 50 kg of Sambaiba soybean seed from Brazil to test it against local seed
- Nucleus farmers who were linked to the demo sites ploughed the fields and their out-growers provided labour.

The table below provides distribution of the inputs.

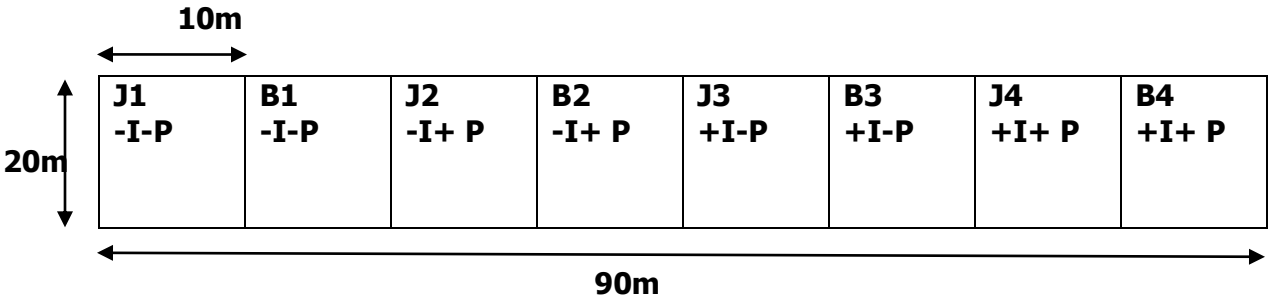
Table 1: Input distribution for the demonstration farms

Input Company	Quantity supplied	NR	UE	UW
Yara legume Fertilizer	25 bags (50kg)	15bags	10bags	N/A
TSP (Upper West)	2bags (50kg)	N/A	N/A	2bags
Certified seed (Jenguma)	200kg	100kg	50kg	50kg
Post emergence Non selective	40 liters	20Lts	10Lts	10Lts
Pre emergence	40 liters	20Lts	10Lts	10Lts
Post Emergence selective	40 liters	20Lts	10Lts	10Lts
Inoculants	40 packs (200gms)	20pks	10pks	10pks

Forty packs of inoculant were supplied for demonstration purposes. Although the quantities in terms of rate of application were less than the 40packs, there were challenges with storage and handling from one location to another.

As part of the larger strategy of promoting the use of inoculants, ADVANCE facilitation through input dealers sold inoculants to farmers. This year, a total of 627 packs (200gms) of inoculants were sold to farmers at a value of GHC 4,702.5.00. A total of 501.6 hectares of land was put in cultivation with the inoculated seeds. Compared to the 2011 growing season; sales of inoculants in 2012 season increased by 87.2%. Although interest in inoculants technology is increasing, actual adoption rate by farmers is low (8%). This is expected to increase as more farmers see the benefits of inoculants from their neighbors and through the soybean demonstrations established by ADVANCE.

Demo Protocol - The design of the demo plots was adopted for two soybean varieties; local Jenguma and Brazilian Sambaiba, a hybrid variety. There were four different treatments across all the sites. The diagram below gives a pictorial view of the demonstration plots. For this report the concern is on the **J1, J2, J3 and J4** plots as per the diagram below. These were the Jenguma planted plots. The technologies that were demonstrated included soybean rhizobium inoculants and Yaralegume fertilizer brand. For the plots and what was treated on them; plot **J1** served as a control plot where activities carried out was similar to that of farmers own practices without the applications of the two technologies, **J2** had incorporation of Yaralegume fertilizer and use of good agronomic practices, **J3** application of inoculants and GAPs and **J4** the combination of Yaralegume fertilizer, inoculants and GAPs. There was a **1m** ally in between the plots. However, sites where the preferred 90mx20m dimension was not suitable, 50mx40m was adopted. Each of the treatment plots has an area of 20mx10 or 40mx5m as shown below



Legend

1. Control **(-I-P)**
2. Fertilizer **(-I+ P)**
3. Inoculant **(+I-P)**
4. Inoculant + Fertilizer **(+I+ P)**

Spacing

60cm X 10cm

Varieties

J= Jenguma

B= Brazilian Hybrid

Planting - Planting started in the last quarter of June through to third quarter of July 2012. The average germination percent was 90% both from the test before planting and after germination. The planting spacing was 60cm inter-row and 10cm intra-row with two seeds per a hill. At the close of the planting period as stated above, 13 of the targeted 40 demos were not

established. Of the 13, seven could not be ploughed due to flooding as result of heavy downpour. Five fields had poor germination as a result of heavy rain fall immediately after planting. The remaining one was lost due to pest infestations two weeks after planting.

Weed control - Three different sets of pesticides (weedicides) were used during the lifetime of the demonstrations. These pesticides put into their broader contact-effects categorization include; Post-emergence non-selective (Zoomer, Glyphader), Pre-emergence non-selective (Activus) and Post-emergence selective (Agil). Input dealers donated the pesticides, as previously mentioned. Besides the pesticides application, manual weeding was done in cases where weed growth was high and or where the pesticides proved ineffective.

Pest and Disease Management - The planted fields were monitored for pest and disease infestation throughout the life cycle of the demonstrations. One of the fields was attacked by a swarm of caterpillars, which destroyed the whole field two weeks after planting. All efforts to control these pests were unsuccessful and the field was abandoned. There were also instances of leave curling insects that attacked the leaves of the plants. Much of this was seen on the plot with the combination of inoculants and Yaralegume fertilizer plots. A biological pest control method of hand picking was recommended and successfully implemented.

Plant Growth, Development and Pod Formation - During this period of the crop cycle, some observations were made with respect to differences in; plant heights, broadness of leaves, plant vigor, flowering and pod formation. In general, the Yaralegume (P2O5: 18, K2O: 12%Mg: Zn: Mo: Bo) and TSP fertilizer showed superiority over the inoculants only plot and both inoculants and the fertilizer plot in any of the above mentioned parameters. Colour difference was also better and evident in the treated plots than the control fields. During flowering, it was observed that the control plot started flowering before any of the other plots a phenomenon that could be attributable to the effects of the technologies used on the treated. This pattern was also observed whereby the control plots reached its complete physiological maturity before other treatment plots. This may therefore suggest that, application of inoculants and or fertilizer affects (delays) maturity period of soybean.

Farmer Field Days - Fourteen farmer Field days were organized for farmers' learning with 396 farmers (Male 188 and 208 female) attending in the three northern regions. The field days were used to educate farmers on the best practices of soybean production such as plant spacing, planting in rows, weed control, pesticide application, use of certified seed and use of new technologies – application of inoculants and Yaralegume/TSP fertilizer. It also offered farmers the opportunity to ask questions regarding these new technologies. The field days were organized during the time where plant height, pod formation and vegetative growth of the treatments showed visible differences. Input dealers also took advantage of the field days to educate farmers on their products and how to properly apply them in order to achieve best

results. There were also media platforms namely, GTV, NorthStar FM station and Business and Financial Times (BFT) presences at one of the field days held at Tibali in the Savelugu district of the northern region.

Data Collection and Analysis - Data was collected and analyzed for 23 demonstration sites out of the 27 planted sites. Three fields were wrongfully harvested by the farmers and one was grazed by animals. In this analysis, all other factors except yields are held constant.
N2Africa project data collection protocol was strictly used to collect data from the 23 demonstration sites. This ensured that the data was uniformly collected to be relevant to the N2Africa project and ADVANCE as well. Two 5m X 4m subplots areas were demarcated on each of the treatment plots, uprooted, counted, detached the pods, weighed the unshelled pods, weighed the haulms, threshed and then the weight of the grains taken. The weight of 1,000 seeds from each subplot was also taken as well as the weight of the haulms. Samples of grains and haulms of each of the treatments from each demo sites were taken for further analysis.

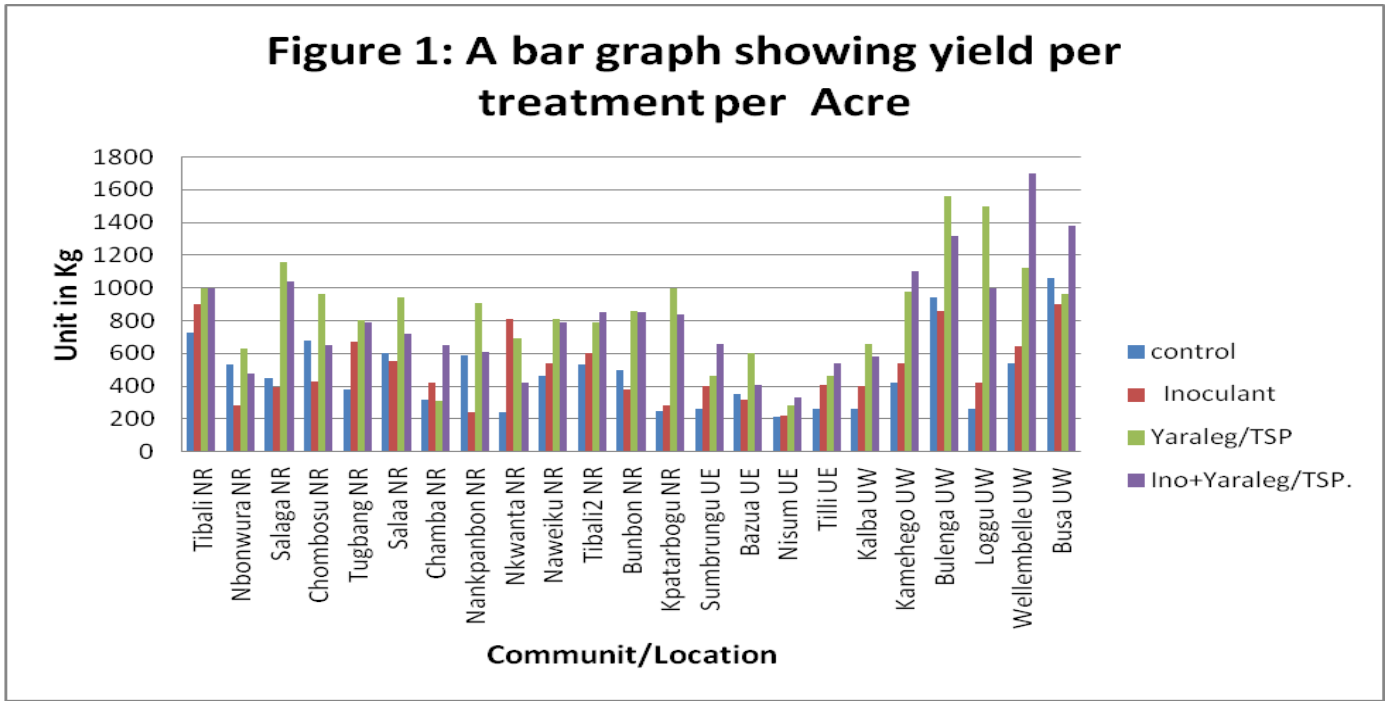
The data from these demo sites are presented in the form of tables and graphs in the next pages of this report. The table below gives an overview of the results at each site per treatment.

Table 1: Extrapolated yield per acre of each treatment

Community	control	Inoculant	Yarale/TSP	Ino+Yaraleg/ TSP.
Tibali NR	730	900	1000	1000
Nbonwura NR	530	280	630	480
Salaga NR	450	390	1160	1040
Chombosu NR	680	430	960	650
Tugbang NR	380	670	800	790
Salaa NR	600	550	940	720
Chamba NR	320	420	310	650
Nankpanbon NR	590	240	910	610
Nkwanta NR	240	810	690	420
Naweiku NR	460	540	810	790
Tibali2 NR	530	600	790	850
Bunbon NR	500	380	860	850
Kpatarbogu NR	250	280	1000	840
Sumbrungu UE	260	400	460	660
Bazua UE	350	320	600	410
Nisum UE	210	220	280	330
Tilli UE	260	410	460	540

Kalba UW	260	400	660	580
Kamehego UW	420	540	980	1100
Bulenga UW	940	860	1560	1320
Loggu UW	260	420	1500	1000
Wellembelle UW	540	640	1120	1700
Busa UW	1060	900	960	1380
Minimum	**210**	**220**	**280**	**330**
Maximum	**1060**	**900**	**1560**	**1700**
Average	**470**	**504**	**845**	**813**
Average % ↑	**0**	**7.2**	**79.8**	**73**

The Figure 1: below gives a pictorial representation of the data in Table 1: extrapolated yield per treatment per acre.



From the **Table: 1** and **Figure:1** above, the results revealed:

- 13 out of 23 sites had Yara legume or TSP fertilizer recording the highest yield,
- inoculants plus fertilizer came up eight times
- inoculants only had the highest yield at only one of the sites.

It was also observed that Tibali field in Savelegu/Nanton district of the Northern Region recorded the same yield for fertilizer only; and fertilizer & inoculants plots.

With regards to yield, the lowest was 210kg from the control and followed by inoculants at 220kg. The highest yield came from fertilizer with inoculant, and fertilizer only was 2nd best performing. It was further observed that the combination of fertilizer and inoculants has a maximum potential yield of 1,700 kg and a minimum of 330kg per acre. This was followed by fertilizer alone of 1,560kg and 280kg respectively. This means that even in a worst case scenario, inoculants plus fertilizer and fertilizer alone treated plots will potentially yield higher than both control and inoculated plots.

The Northern and Upper East regions used Yaralegume fertilizer, while TSP was used in the UWR. An observation from the table and graph above indicate that TPS brand of fertilizer seems to indicate better yields and good synergy than the Yaralegume fertilizer. Unlike in the NR where there was a better response in terms of highest yields using YaraLegume fertilizer, the same could not be observed in the other regions.

There was a largely consistent pattern where (a) inoculants showed a better response than control, (b) fertilizer over inoculants, and the (c) combined effects of inoculant and fertilizer over each. The most important of these observations is that there are significant increases in yields using either inoculants and or fertilizer over current practices (Control) in the production of soybeans.

Of the 23 sites where data was collected; inoculants, fertilizer and the combination of the two perform; 14, 21 and 22 times respectively better than control. From the average yield per treatment, (a) inoculants increases yields by 7.2% over control, (b) fertilizer by 79.8% and (c) the combination by 73.0%. This however, cannot form the basis for any business decision making for one option over the other as this must be analyze against its production cost to determine the profitability or otherwise of these investment options.

This trial results re-affirm earlier findings that most soils in the north have exhausted or are exhausting their fertility and need to be replenished for increased soybean yields. This concurred with the results of the soil analysis which indicates that the soils were generally low in nitrogen and available phosphorus, and moderate in exchangeable potassium. These major nutrients are the constituents of YaraLegume or TSP fertilizer and hence its performance in terms of yields presented. This result can be helpful in making farmers understand that soybean production requires the application of appropriate fertilizer based inputs, a phenomenon which is not known among most soybean farmers.

A sample gross margin analysis of the Upper East Region demonstration plots in four locations of Sumbrungu, Bazua, Ninsum and Tilli, suggest that the highest gross margins averages came from Legumefix inoculant on its own, followed by Legumefix inoculant and Yaralegume fertilizer. Further analysis is required to determine why some sites, such as Ninsum plot with inoculant and fertilizer received such low revenue. Farmers yields and agricultural practices still need improving, particularly with the post-harvest handling stage, but in the case of the demonstrations the ADVANCE staff were directly involved with assisting at harvest and threshing stages.

Sample Gross Margin Analysis, Upper East Region

Treatment	Control			Inoculants			Fertilizer			Inoculant + Fertilizer		
UER Location	**Cost**	**Rev.**	**GM**	**Cost**	**Rev.**	**GM**	**Cost**	**Rev.**	**GM**	**Cost**	**Rev.**	**G M**
Sumbrungu	256.5	234	**-22.50**	201	360	**159**	533.5	414	**-119.50**	541	594	**53**
Bazua	249.5	315	**65.5**	194	288	**94**	526.5	540	**13.50**	534	369	**165**
Ninsum	238.5	168	**-70.50**	183	176	**-7**	510.5	225	**-286.50**	518	264	**-254**
Tilli	249.5	234	**-15.50**	194	369	**175**	526.5	414	**-112.50**	534	486	**-48**

Conclusion - The objectives for setting up the demonstration farms in collaboration with other stakeholders were largely achieved. Nucleus farmers and lead farmers from each of the locations showed their full commitment and learning enthusiasm throughout the period. Ploughing of fields was done at the right time; planting as well as data collection also within range and no field shattered as a result of late harvesting. Most farmers for the first time saw and believed that soybean production requires the use of fertilizer to increase yield. This was something they experienced for the first time and have developed interest in using fertilizer and inoculants come next season. The performance of the certified seed used, in terms of germination and plant vigour, also convinced farmers that the first step to increase yields of soybean is to use good seed. The participation of value chain actors and other institutions like MOFA and N2Africa was also instrumental in the success of all activities related to the demonstrations.

There were also some challenges encountered such as weather factors reduced the number of demos established. The 12 sites that could not be established, apart from five sites which were not suitable in terms of visibility and proximity to farmer audience, the remaining 7 were abandoned due to rainfall related factors. Four sites were flooded and could not be ploughed within time while the other three poorly germinated due to heavy downpours.