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FONDATION AFRICAINE POUR LES TECHNOLOGIES AGRICOLES

Seeds2B Project

Malawi Evaluation Trials
2014/2015 Winter (Dry) Season

Soybean Trial Implementation Update

February 2016

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Background

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The Seeds2B Project fosters the development of "seed bridges" that link crop breeding initiatives to sub-Saharan Africa's (SSA) seed systems. The Project facilitates the transfer of better-performing, locally adapted and market-appropriate crop varieties developed by public and private breeders based in and outside Africa to smallholders in SSA through local seed producers and distributors. By adding new commercially viable products to the portfolios of local seed enterprises, the Seeds2B Project helps smallholders in the region serve new markets with the best of locally grown produce. The ultimate goal of the Seeds2B Project is to contribute towards building the capacity of SSA's commercial seed sector and advancing food security in Africa.

A dedicated team of experts from the African Agricultural Technology Foundation (AATF) and the Syngenta Foundation for sustainable Agriculture (SFSA), comprising experienced plant breeders, intellectual property rights experts, business strategists, product deployment professionals and seed policy specialists work alongside local partners to implement Seeds2B initiatives in SSA. Local partners involved include National Agricultural Research Systems; farmer groups, processors and technical organisations specialized in variety screening; organisations that have capacity to demonstrate new improved crop varieties with large numbers of farmers; organisations that link credit or savings to seed purchase; and seed producers and distributors. The Seeds2B partnership:

- Negotiates with private and public breeders for access to high potential crop varieties.
- Assess and benchmarks the performance, adaptability and market acceptance of accessed varieties in research and farmer fields across target agro-ecologies to justify registration and commercial release.
- Provides risk mitigation support for breeders, smallholders and local seed enterprises. This may include creation of advance market demand, guidance on protection of intellectual property rights and direction on regulatory matters.
- Oversees brokered commercial partnerships between local seed enterprises and breeders to ensure benefit for all and more so smallholders in SSA.

AATF is implementing a pilot of the Seeds2B initiative in Malawi and Zimbabwe and leads the scaling of Seeds2B initiatives across SSA.

About AATF (www.aatf-africa.org)
The African Agricultural Technology Foundation is a not-for-profit organisation that facilitates and promotes public/private partnerships for the access, development and delivery of appropriate agricultural technologies for sustainable use by smallholder farmers in Sub Saharan Africa (SSA) through innovative partnerships and effective stewardship along the entire value chain.

About SFSA (www.syngentafoundation.org)
The Syngenta Foundation for Sustainable Agriculture creates value for resource-poor small farmers in developing countries through innovation in sustainable agriculture and the activation of value chains.

Introduction

Soybean is regarded as smallholder friendly crop as it displays reasonable tolerance to both abiotic and biotic stresses. The crop is also ideal for crop rotation as it is able to fix atmospheric nitrogen, which increases soil fertility during growth. Soybean thus presents a valuable tool for agricultural diversification, soil improvement and risk mitigation for smallholder farmers in sub-Saharan Africa.

Soybean consumption is soaring in most countries of sub-Saharan Africa, driven by a strong industrial demand in the areas of animal feed and vegetable oil production. However, in many regions of sub-Saharan Africa, average soybean yields are below 1 t/ha, whereas yield of at least 2.5 t/ha are regarded as feasible. Apart from low levels of agronomic know-how at smallholder farmer level, one of the main reasons of such low productivity is the lack of smallholder access to quality seed of a range of adapted soybean varieties that perform well under tropical conditions.

Given this context, the African Agricultural Technology Foundation (AATF) and the Syngenta Foundation for Sustainable Agriculture (SFSA) are working alongside the Soybean Innovation Lab (SIL) on an initiative aimed at introducing new improved tropically-adapted soybean varieties in several regions in Southern, East and West Africa. The Soybean Innovation Lab is a consortium of US universities dedicated to establish viable soybean value-chains across Africa, with breeding for tropically adapted varieties being a major focus area of this consortium **(http://soybeaninnovationlab.illinois.edu/)**. As part of the initiative, soybean evaluation trials will implemented through the Seeds2B demand-led approach. Therefore, processors, input suppliers and seed traders will be engaged during the trial phase. These engagements will aim to facilitate the establishment of a supply of quality seed of better performing soybean varieties to smallholder farmers thus enhance functional value-chains for locally produced soybean.

This update provides the first complete set of data following small scale soybean evaluation trials implemented in Malawi over the 2014/2015 winter (dry) season. A brief discussion is included to provide context to the results. The update reports on the performance of 9 soybean varieties (6 test and 3 check varieties) planted at Kasinthula Experiment Station on 3 July 2015. Evaluation of the entries at Chitala Experiment Station was severely affected by moisture stress leading to the discontinuation of data collection at this site. Details on the trial sites and a brief on the trial partner involved in the evaluations are available in appendix 1.

Yields, agronomic characteristics and disease ratings for 9 soybean varieties evaluated at Kasinthula, Malawi

Entry Code	Emergence (%)		Vigor Score[2] at 14 Days			Vigor Score[2] at 21 Days			50% Flowering (Days)		Maturity (Days)		Grain Yield (tons/ha)		Fodder Yield (tons/ha)	
	Mean	SE[1]	Median	Min	Max	Median	Min	Max	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Soy 1	49.02	15.84	4	1	5	5	1	5	59.0	0.0	136.33	1.67	3.39	1.27	1.73	0.17
Soy 2	36.11	2.55	3	3	3	3	2	3	52.0	0.00	121.00	1.00	2.72	0.50	1.59	0.13
Soy 3	30.56	7.28	2	1	2	2	1	3	47.33	0.67	118.67	1.76	2.02	0.76	1.36	0.24
Soy 4	42.32	3.74	3	3	3	3	3	4	56.33	5.67	121.00	2.087	2.09	0.09	1.58	0.18
Soy 5	47.38	1.18	3	3	4	3	3	4	49.67	1.20	114.33	.33	2.33	1.05	1.20	0.34
Soy 6	33.33	11.03	3	1	4	3	1	4	47.67	0.88	122.33	1.67	1.30	0.18	1.43	0.30
Nasoko	62.75	3.81	4	4	5	3	3	3	42.67	0.33	115.00	.00	2.20	0.50	1.28	0.27
Tikolore	70.10	3.21	5	3	5	5	4	5	44.67	0.88	113.67	.33	3.01	0.78	1.02	0.40
Serenade	49.18	8.03	4	3	5	5	4	5	42.67	0.67	121.33	.88	2.76	0.90	1.16	0.33
ANOVA F-Statistics	3.1								20.6		28.013		0.657		0.7	
Chi-Square			44.1			36.75										
P-Value	0.022		0.075			0.258			<0.001		<0.001		0.722		0.687	

[1] SE=Standard Error

[2] Vigor score key:

- 1 = Very weak
- 2 = Weak
- 3 = Intermediate
- 4 = Strong
- 5 = Very strong

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Entry Code	Pod Clearance (cm)		Pod Shattering Score[3] (157 days post planting)			Pods per Plant (Count)		Grains per Pod (Count)		Weight of 100 Grains (g)		Grain Appearance Score[4]			Nodulation Score[4]		
	Mean	SE	Median	Min	Max	Mean	SE	Mean	SE	Mean	SE	Median	Min	Max	Median	Min	Max
Soy 1	11.867	.6667	1	1	1	184.00	42.44	2.80	.20	82.80	2.23	1	1	1	1	1	2
Soy 2	8.800	.4163	1	1	1	137.00	36.19	2.80	.20	50.40	1.0	2	2	2	3	1	3
Soy 3	5.067	.5207	1	1	3	166.00	29.05	3.00	.00	56.13	1.05	1	1	1	2	1	5
Soy 4	12.467	1.1851	1	1	3	120.67	30.73	3.00	.00	60.40	3.99	3	3	3	1	1	2
Soy 5	6.267	.4667	1	1	1	199.67	17.07	2.80	.20	59.93	1.07	2	2	2	5	1	5
Soy 6	4.667	.3712	1	1	1	144.00	19.70	2.73	.27	38.93	1.57	3	3	3	4	1	5
Nasoko	5.000	.0000	1	1	1	96.67	.33	2.67	.33	44.60	.92	2	2	2	2	2	5
Tikolore	10.800	.2000	2	1	2	112.00	2.52	3.07	.07	74.07	1.38	3	3	3	2	1	5
Serenade	5.400	.3055	1	1	1	175.33	11.32	2.80	.20	71.07	2.72	1	1	1	1	1	3
ANOVA F-Statistics	32.98					28.013		0.648		1.146							
Chi-Square			23.64									54			31.919		
P-Value	<0.001		0.098			<0.001		0.728		0.381		<0.001			0.471		

[3] Pod shattering score key:
- 1=no pods shattered
- 2=25% of pods shattered
- 3=50% of pods shattered
- 4=75% of pods shattered
- 5= all pods shattered

[4]Grain appearance and nodulation score key:
- 1 = Very poor
- 2 = Poor
- 3 = Intermediate
- 4 = Good
- 5 = Extremely good

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Entry Code	Red Leaf Blotch Score[5]			Soybean Rust Score[5]			Green Stem Score[6]			Plant Height (cm)		Flower Color	Hair Color	Hilum Color
	Median	Min	Max	Median	Min	Max	Median	Min	Max	Mean	SE			
Soy 1	2	2	3	1	1	2	1	1	1	82.80	2.23	Purple	Grey	Brown/Cream
Soy 2	3	3	3	2	1	2	1	1	1	50.40	1.0	Purple	Grey	Brown/Cream
Soy 3	1	1	2	3	3	3	2	2	2	56.13	1.05	White	Grey	Brown/Cream
Soy 4	1	1	2	1	1	2	1	1	3	60.40	3.99	Purple	Grey	Brown/Cream
Soy 5	3	2	3	2	1	2	1	1	2	59.93	1.07	Purple	Grey	Brown/Cream
Soy 6	1	1	2	3	3	3	3	1	3	38.93	1.57	Purple	Brown	Brown/Cream
Nasoko	1	1	2	3	3	3	3	2	3	44.60	.92	Purple	Brown	White
Tikolore	1	1	2	3	3	3	1	1	2	74.07	1.38	Purple	Brown	Brown/Cream
Serenade	1	1	2	1	1	2	2	2	3	71.07	2.72	White	Brown	Black
Chi-Square	21			13.648			26					N/A	N/A	N/A
ANOVA F-Statistic										49.833				
P-Value	0.179			0.091			0.054			<0.001				

[5]Red leaf blotch and soybean rust score key:

- 1=no lesions
- 2=few lesions on some plants
- 3=some lesions on all plants
- 4=severe infection
- 5=severe infection with abscission

[6] Green stem score key:

- 1 = All stems dry at date of recording shattering
- 2 = up to 50% of stems green at date of recording shattering
- 3 = Most stems green with some green leaves on the plants at date of recording shattering

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Discussion

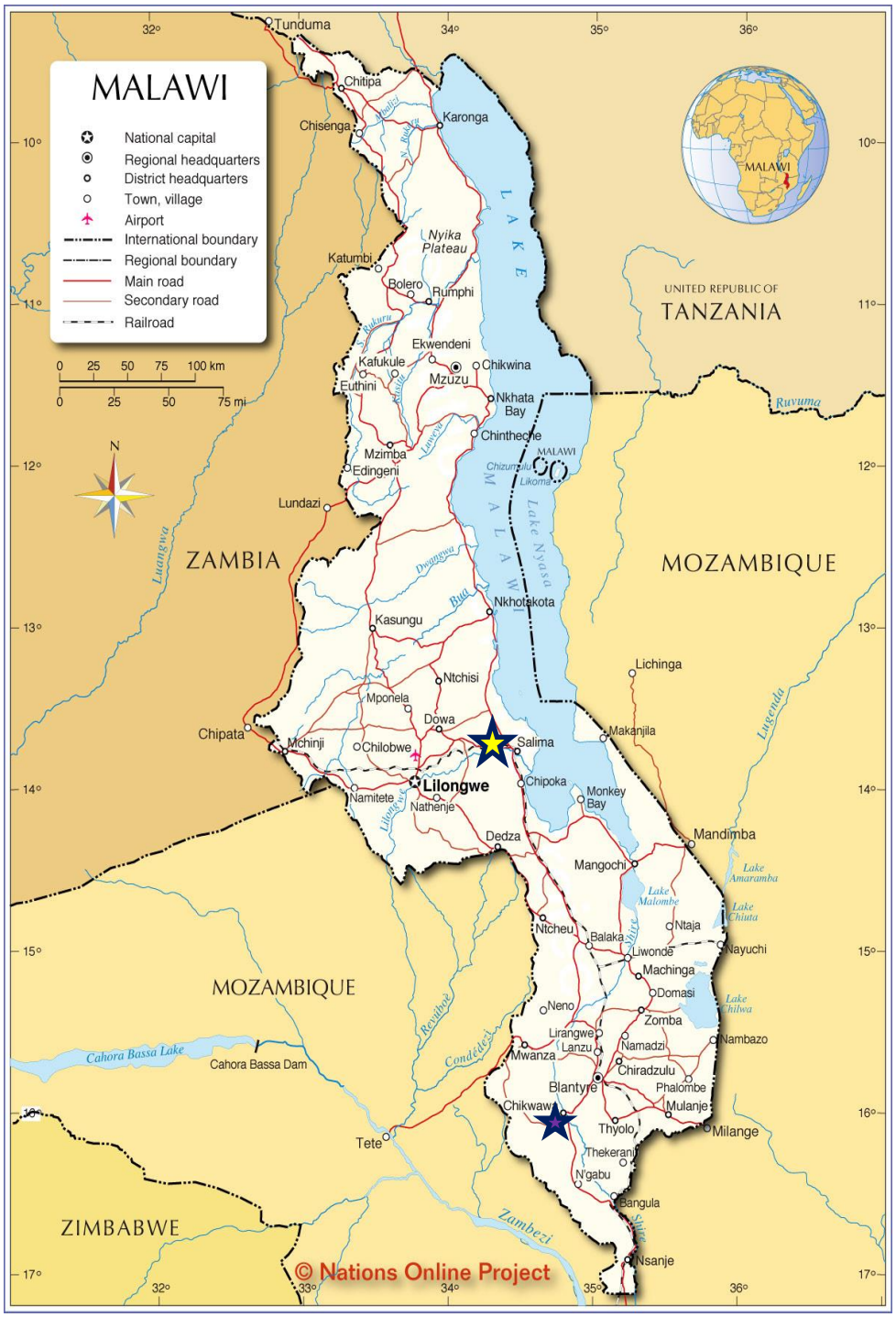
The experiment was planted on 3 June 2015 in a randomized complete block design with three replications. Each plot contained 5 rows of 70 plants. Seeds were spaced 5cm apart in the row with rows spaced 75cm apart. An inoculant was applied at planting. No additional fertilizer was applied to the field to mirror smallholder farmer's practice. Soil profile data for the trial site is provided in appendix 2. Prior to the trial, rice was planted on the area covered by the trial plots.

Data on emergence was collected 7 days after planting, which may have been too soon as seedlings that emerged after 7 days were not accounted for while considering emergence despite them contributing to other evaluation parameters, including yield. Going forward, emergence at 21 days will be considered so as to cater for emergence under ideal as well as stress conditions which may delay germination. The emergence and development of a replication of Soy 1 and Soy 3 was heavily affected by flooding while that of Nasoko, Soy 4, Soy 5, Tikolore and Serenade were moderately affected. In addition, a replication of soy 6 and Serenade was moderately affected by termite damage. Nasoko was initially erroneously labelled as Makwacha on planting. This inadvertent error was identified in the field and the name of the check variety has been amended in the current report.

The average-low grain appearance scores recorded by most varieties is attributed to low grain filling in pods situated on the upper parts of plants and shriveling of grains in the field as a result of rapid moisture loss. Average grain moisture content recorded at harvest was 9.3%, with no statistically significant difference between the varieties, against ideal moisture of 13-16% at harvest. Compared to the other entries, it was noted that the roots of Soy 2, Soy 5, Nasoko and Tikolore displayed big nodules. Weather readings at Kasinthula were not available.

Way Forward

Small scale multi-location evaluation trials of the 9 entries have been established at 4 sites in Malawi over the 2015/2016 season so as to assess performance under varied environments. Technology scouting efforts remain focused on identifying early-medium maturing varieties (<110 days) with potential for producing high yields (>2.8 tons/Ha) with qualities suitable for processing (Oil content >15% and Protein content >38%).



Appendix 1

Trial Site:

★ Kasinthula Research Station: latitude 16° 00' S, longitude 34° 05' E - Altitude 60m

★ Chitala Experiment Station: latitude 13°40'S, longitude 34°15'E - Altitude 606m

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Trial partner

- **Department of Agricultural Research Services (DARS)** is the Malawian national research programme. DARS is mandated to conduct research on all crops and livestock production, except for tobacco and tea, in all the eight agro-ecological zones of Malawi. It also provides regulatory and special services to stakeholders in agriculture, including technology dissemination, social-economic studies, statistics and seed technology services. (http://www.erails.net/MW/dars-info-centre/)

Appendix 2

Soil Profiles

Site	pH	% OC	% OM	%N	% Clay	% Silt	CLASS
Chitala	7.035	0.6	1.035	0.05	44	8	SCL
Kasinthula	7.185	0.825	1.425	0.07	35	15	SCL

SCL=Sandy clay loam

Threshold values

Soil pH in water	in $CaCl_2$	Rating
< 4.5	<4.0	Very strongly acid
4.5 - 5.0	4.0 - 4.45	Strongly acid
5.1 - 5.5	4.5 - 4.95	Acid
5.6 - 6.0	5.0 - 5.45	Moderately acid
6.1 - 6.5	5.5 - 5.95	Slightly acid
6.6 - 7.0	6.0 - 6.45	Almost neutral
7.1 - 7.5	6.5 - 6.95	Very slightly alkaline
7.6 - 8.0	7.0 - 7.45	Slightly alkaline
> 8.0	-	Alkaline
-	7.45 - 7.95	Moderately alkaline
>8.5	> 8.00	Strongly alkaline

% Carbon	Organic matter%	Rating
< 0.88	1.5	Low
0.88 - 2.35	1.5 - 4.0	Medium
> 2.35	> 4.0	High

Total Nitrogen %	Rating
Fine texture (clay, sand clay loam)	
< 0.08	Very low
0.08 - 0.12	Low
0.12 - 0.20	Medium
0.20 - 0.30	High
> 0.30	Very high