Stress Tolerant Orphan Legumes (STOL) project in Burkina Faso

Stol project zoom-meeting, 22-24 November 2023

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INTRODUCTION

STOL project activities, which aimed at the identification of legumes that are well adapted and adopted in Burkina Faso. It started with some experimentation at Kamboinsé INERA-research with 6 introduced species from NBPGR, (Mung bean, Moth bean, Horsegram, rice-bean, dolichos and Bambara groundnut). After field visits of the trials with farmers, mung bean and dolichos were selected for farmers' field trials.

Mung bean and **dolichos lines** were then selected to be tested in these fields.

Then, seven (07) mung bean lines and two(02) dolichos lines were kept to enter the selection process of varieties registration.

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Lines registration in Burkina Faso

Lines registration go through several stages which can be summarized :

- Preliminary in-station tests
- Advanced in-station tests
- Advanced tests on different sites in farmer' field

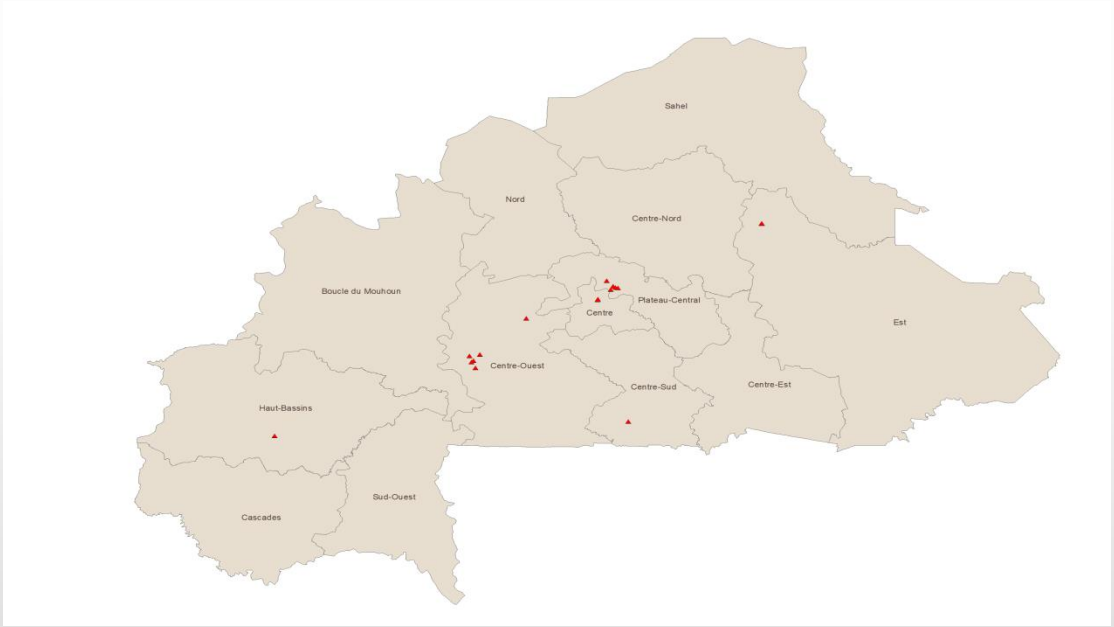
(**2 seasons on 5 sites**)

- DHS tests (**Distinctness; Homogeneity; Stability**): if a given variety is truly distinct from another variety registered in the catalog; plants from a seeds lot will be homogenous and if the line is stable
- ATV test (**Agronomical and Technological Value**): description of the cultural value (yield, cycle…) of the variety in the main pedo-climatic conditions that it could be grown in the country

- Variety submission to the national comity for registration in the catalog (National and ECOWAS)

Background

During last year's cropping season (2022-2023), the multi-locations trials were conducted in 5 locations on mung bean (7 lines and one control) and dolichos (2 lines and 1 control).



Trial locations	**Rainfall (mm..)**
-Mani	637,6
-ZINIARE: Donsin,Tamassa,Goué,Rogmnoogo	823.5
-Tita : Ividié, Tiodié, Tamboassa, Napone	1021.8
-Kamboinse, Saria (on station trials)	1091,7

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Background

Objectives: identification of adapted genotypes among the 7 mung bean and dolichos lines with regard to the different agro-ecological zones of the country :

MUNG BEAN (*Vigna radiata*)		
N°	**Lines**	**Origin**
1	IC-103245	NBPGR
2	AVMU 1656	AVRDC
3	AVMU 1657	AVRDC
4	IPM 02-14	NBPGR
5	GANGA 1	NBPGR
6	AVMU 1621	AVRDC
7	**Beng-tigré (Check)**	INERA
8	AVMU 1614	AVRDC

DOLICHOS (*Lab-lab purpureus*)		
N°	lines	Origin
1	IC0623093	NBPGR
2	HA3	NBPGR
3	D167(Check)	NBPGR(PhD)

Data recorded: yield per line (g/ha),cycle, growth habit….

Experimental design: RCBD with two replicates and one (01) control for each specie

_ **Mung-bean** : 4x3 m rows. inter-row: 50 cm and within-row : 20 cm from plant to plant

_ **Dolichos** : 3x3 m rows. inter-row: 80 cm and within-row : 30 cm from plant to plant

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Manni

Tita (Tiodié, Tamboassa)

Ziniare (Goué)

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Kamboinse

Saria

Farmer' field day were held in the three (03) locations including Mani, Donsin and Ividié during which farmers where invited to indicate the best line regarding field performance:

Field day at Goué (Ziniaré)

Field day at Ividié (Ziniaré)

Field day in Mani

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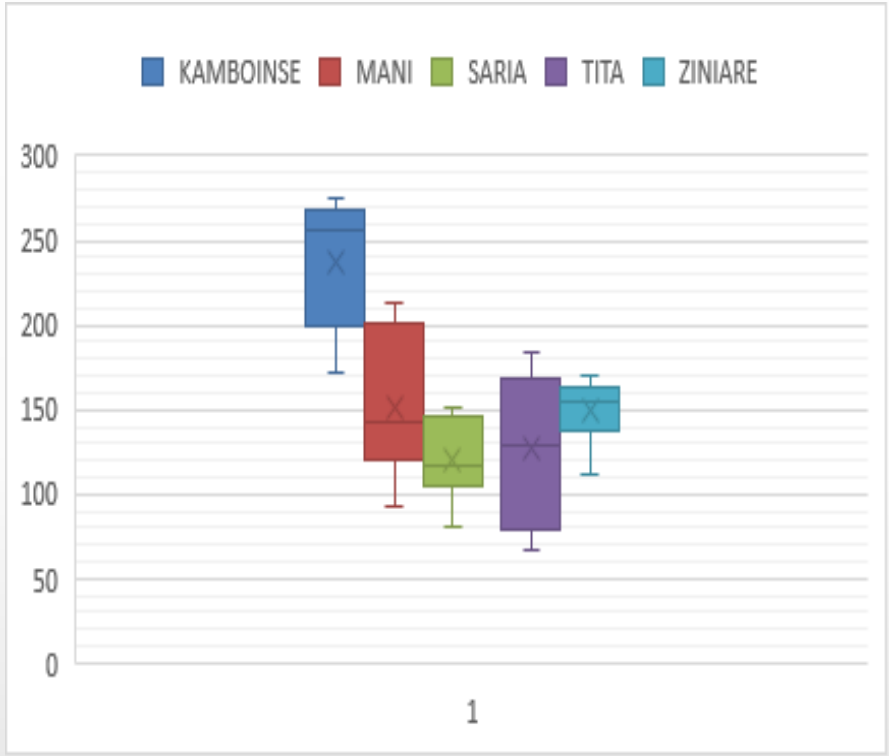
Results

Mung bean lines performances in each environment (2022)

Genotypes	Environments					Total(g)
	KAMBOINSE	MANI	SARIA	TITA	ZINIARE	
AVMU1614(gr)	211.2	93.3	143.6	169.3	144.4	761.8
AVMU1621(gr)	**256.2**	**210.9**	**147.9**	165.4	112.3	**892.7**
AVMU1656(gr)	195.3	153.5	108.6	**73**	134.9	665.3
AVMU1657(gr)	**268.7**	131.9	121.5	134.3	153.4	809.8
BENGTIGRE	265.7	126.2	**150.5**	**184.3**	164	890.7
GANGA1(gr)	172.2	**212.6**	112.2	124.7	**162.1**	783.8
IC103245(gr)	**275.3**	117.2	102.7	67.4	**170.5**	733.1
IPM0214(gr)	257.4	168.6	80.5	100.3	157.2	764
Max	275.3	212.6	150.5	184.3	170.5	892.7
Min	**172.2**	93.3	80.5	67.4	112.3	665.3
Means (gr)	**237.75**	**151.77**	120.94	127.34	149.85	



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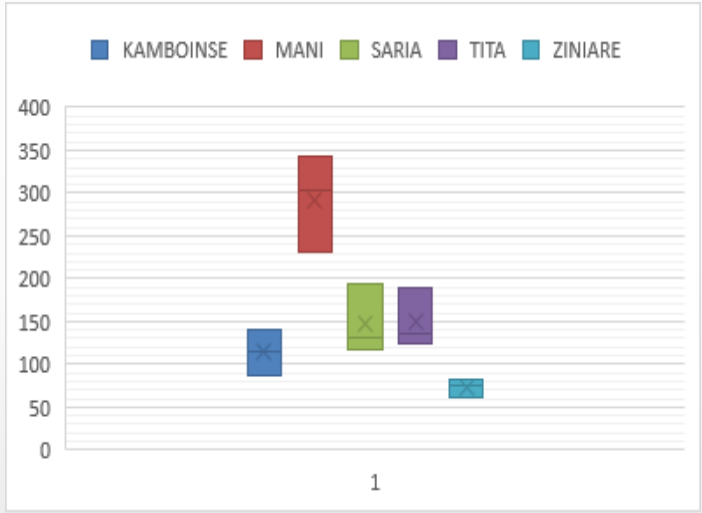
DOLICHOS (*Lab-lab purpureus)* lines performances in each environment (2022)

Genotypes	Environments					Total(gr)
	KAMBOINSE	MANI	SARIA	TITA	ZINIARE	
D167 (ck) (gr)	117.1	231.05	**194.6**	**189.5**	76.9	**809.15**
HA3 (gr)	86.8	**342.7**	117.025	123.2	60.4	730.125
IC0623093 (gr)	**140.7**	313.2	119.2	123.8	**81.9**	778.8
Max(gr)	140.7	342.7	194.6	189.5	81.9	809.15
Min (gr)	86.8	231.05	117.03	123.2	60.4	730.125
Means(gr)	114.8	**295.6**	143.6	145.5	73.06	772.7



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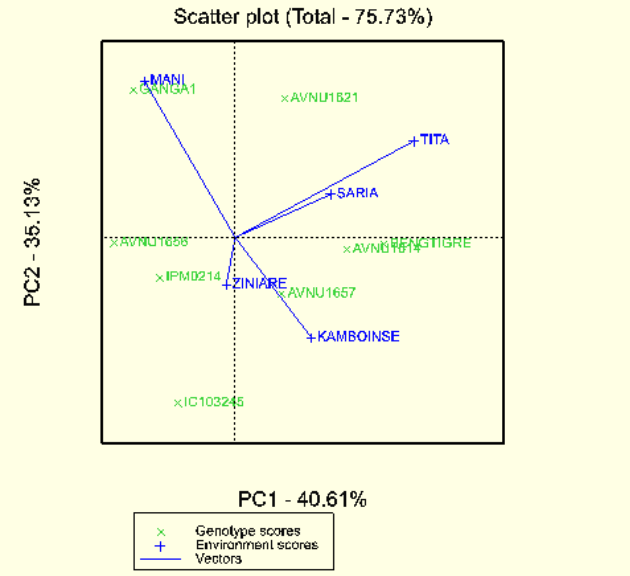
Field's visit

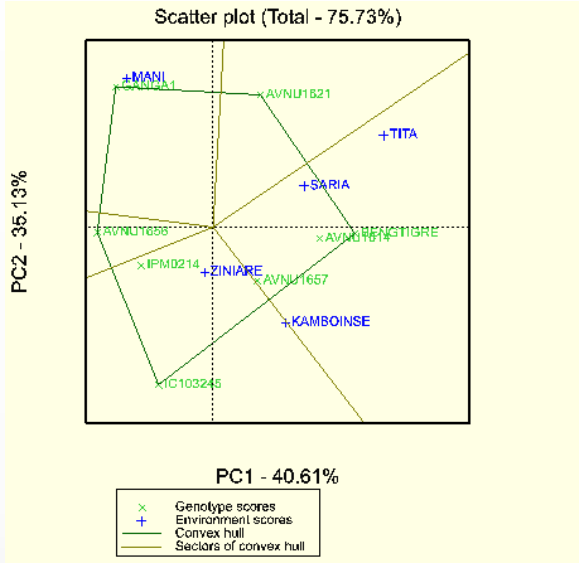
In Donsin, Tita and Manni, farmers where allowed to choose their prefered line among mung bean lines on trial, and results are as follow:

Locations	Prefered lines
ZIniaré	**IC-103245**
Tita	**AVMU1614**; **AVMU1621**
Manni	**GANGA1**

in order to identify stable or ideal environment and also best lines among mung bean and Dolichos line, G x E interactions studies where performed using GGE-biplot and AMMI analysis.

Mung bean (*Vigna radiata*)





the most representatives environments during this rainy season was Tita (the wetter area with 1021,8mm rainfall) and Mani (the driest area with 637 mm). Also, Saria appear to be lincked with Tita, while Ziniare is corélated with Kamboinsé.

GANGA1 appears to be the best genotype followed by AVMU1621 while AVMU1656 appear to be the lowest yielding genotype. Effectively, GANGA1 with a yield of 212,6 gr is the top yielder, followed by AVMU1621 with 210,9gr in Mani the most representative experimentation site. IC103245 with 117,2 gr is one of the poorest genotypes with AVMU1614.

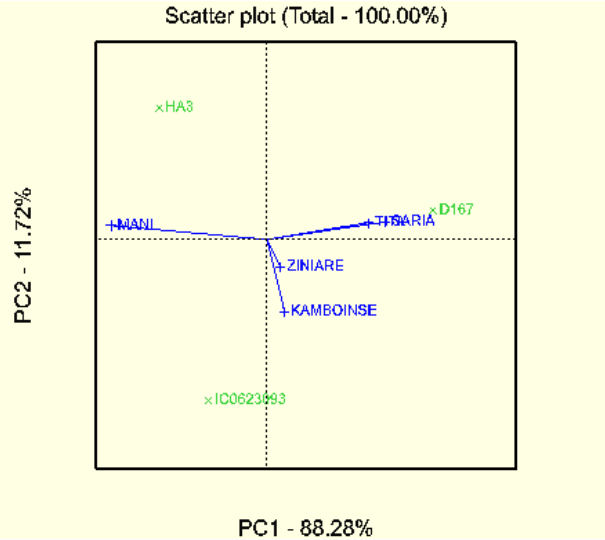
Mung bean (*Vigna radiata*)

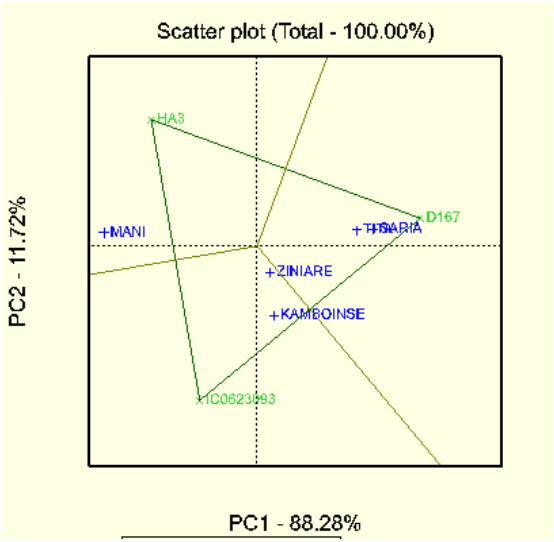
best AMMI model allows to select relatively best genotypes that suit to a specific environment. So, the four best genotypes selected by AMMI model for each environment are

ımber	Environment	Mean	IPCA1Score	1	2	3	4
1	KAMBOINSE	237.8	4.912	IC103245	BENGTIGRE	AVMU1657	IPM0214
4	TITA	127.3	2.739	BENGTIGRE	AVMU1614	AVMU1621	AVMU1657
3	SARIA	120.9	1.514	BENGTIGRE	AVMU1621	AVMU1614	AVMU1657
5	ZINIARE	149.8	0.555	IC103245	BENGTIGRE	IPM0214	AVMU1657
2	MANI	151.8	-9.721	GANGA1	AVMU1621	IPM0214	AVMU1656

Based on this table, some genotypes seem adapted to more than one site: AVMU1621 looks adapted to MANI, SARIA and TITA, Genotype IPM02014 is adapted to MANI ZINIARE an Kamboinsé, AVMU1657 is adapted to Kamboinse, TITA, SARIA and ZINIARE. **GANGA 1** is adapted to the driest part MANI while BENGTIGRE the current cultivated line, used as check in this study is only adapted to the wetter part of the country.

DOLICHOS (*Lab-lab purpureus*)





scater-plot, confirmed that Mani was the most ideal environment and then Saria and Tita which again appears to be adjacent, like ZINIARE and Kamboinse.

HA3 was the most stable genotype. In contrary, IC0623093 was the low yielder, so the least adapted, since it is only adapted to Ziniare and Kamboinse, the least ideal environment but where he was the best genotype.

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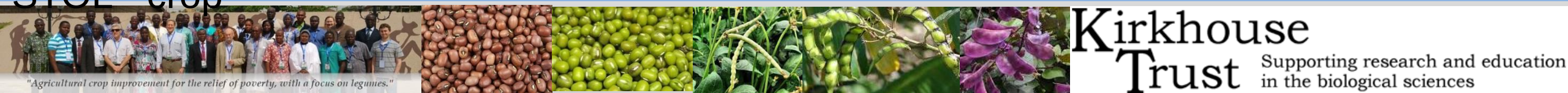
Discussions

For mung bean, farmers preferred line during farmer field day clearly depend on the line performance. In ZINIARE, **IC-103245 was the choice of the farmer. This line was the best in the zone as it have been confirmed by AMMI model . Also, In Tita, AVMU1614** the best line according to farmer have also been confirmed by analysis as the most adapted line for this region after BENGTIGRE, the current line they are growing in TITA.

Results generated by G x E analysis in addition with farmers choice allows us (with Dr Prem suggestions) to conduct a bigger scale trial. For each of the 03 most adapted lines **(Ganga1; AVMU1621 and IC-103245)**, 1ha where dedicated in Manni, the drought prone area to host the trial for the current cropping season in addition with other trial regarding STOL - crop



STOL_activities for 2023-2024 cropping season

For this growing season, three species were on trial, while two other species were used for multiplication.

The species under experimentation are as follows: Tepary beans, Mung bean, Dolichos

-**Mung bean, Dolichos trials** are in line with last year's trials, and the protocol required for registration (last step: **DHS; ATV-tests**).

-**Tepary bean lines** received from UC-Davis (Travis) have also been put on trial on four sites (Farako-ba; Kamboinsé; Po and Manni).

Species under multiplication are as follow: **Moth bean and Bambara groundnuts**

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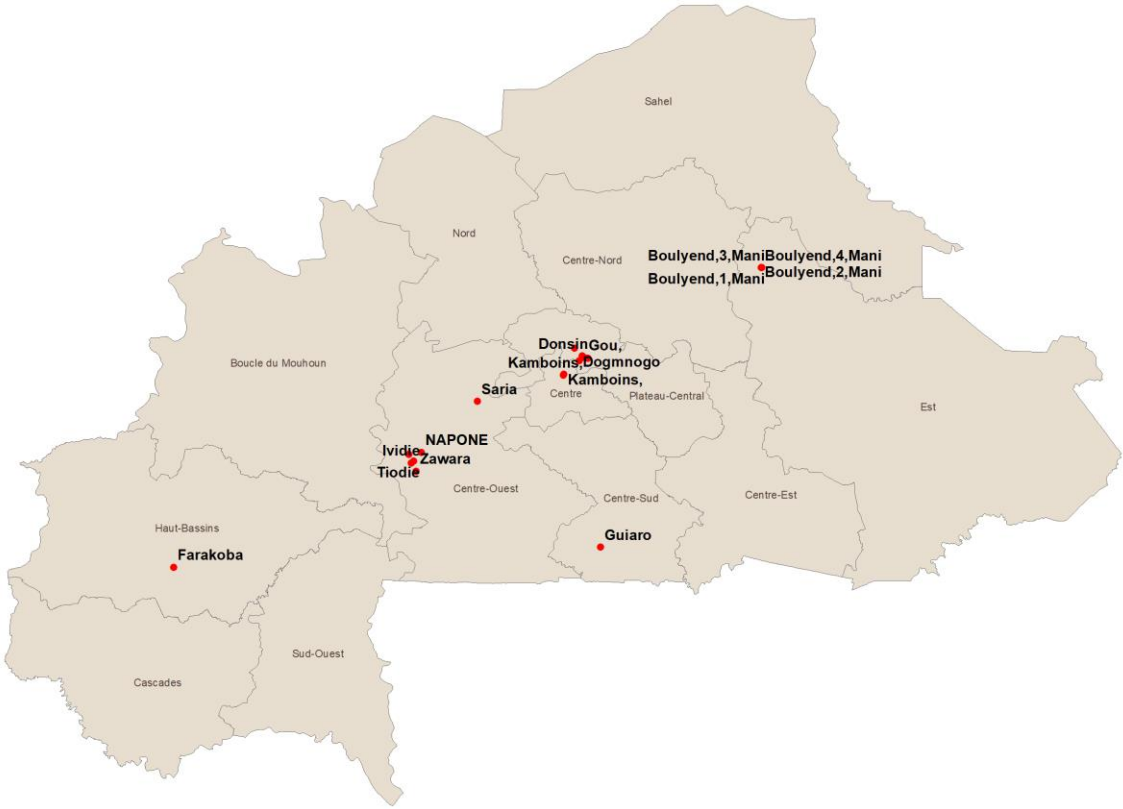
Trials locations

District	Villages	Species
Ziniaré	Donsin	Mung bean+ Dol
	Goué	Mung bean+ Dol
	Tamassa	Mung bean+ Dol
	Rogmnogo	Mung bean+ Dol
	Tamporin	Mung bean+ Dol
Tita	Naponé	Mung bean+ Dol
	Ividié	Mung bean+ Dol
	Tuodié	Mung bean+ Dol
	Elinga	Mung bean+ Dol
	Zawara	Mung bean+ Dol
Manni	Boulyendé1	Mung bean (1ha)
	Boulyendé2	Mung bean (1ha)
	Boulyendé3	Mung bean (1ha)
	Boulyendé4	Mung bean+ Dol+ Tepary bean



New site: Po (Guiarro), Farako-ba
Research station: Kamboinsé; Saria

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Experimentation details and information

For mung bean and Dolichos

Experimental design:

Randomized Complete Bloc Design with two replicates and one (01) control for each specie

Spacing:

_ **Mungbean**: 4x3 m rows. 50 cm between rows, and 20 cm from plant to plant:

_ **Dolichos**: 3x3 m rows. inter-row: 80 cm and within-row plant to plant: 30 cm

Fertilization: spreading of 50 kg of NPK fertilizer at a dose of 50 kg / 200m^2

Data recorded: yield per line (kg/ha) recorded on two central rows

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Ziniaré

Date of planting: from 11 to 12th August

Donsin: Mung bean

Donsin: Dolichos

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Ziniaré

Rogmnoogo

Tamassa

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Tita

Date of planting: from 12 to 28th August

Ividié

Harvest in Napone

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Manni

Date of planting: from 02 to 09th September

Boulyendé 2, Line: Ganga1

Boulyendé 3, Line: AVMU1614

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Tepary beans (*Phaseolus accutifolius*) evaluation

Lines on trial

Lines	Origins
TARS-Tep 23	UC Davis
PI 440786	UC Davis
PI 310801	UC Davis
G40068	UC Davis
G40006A	UC Davis
G40119	UC Davis
G402200	UC Davis
G40173A	UC Davis
TARS-Tep 22	USDA-ARS PR
TARS-Tep 93	USDA-ARS PR
TARS-Tep 51	USDA-ARS PR
TARS-Tep 58A	USDA-ARS PR
TARS-Tep 97	USDA-ARS PR
TARS-Tep 100	USDA-ARS PR
TARS-Tep 101	USDA-ARS PR
TARS-Tep 112	USDA-ARS PR
TARS-Tep 32	UC Davis

Check lines

Lines	Origins
G40301	CIAT-Colombia
G40066	CIAT-Colombia
G40011	CIAT-Colombia
Local	TBD

These tepary bean lines were tested at three research stations and two farmers' fields.The experimental design used was an RCBD with three replicates. Each accession was sown on two 3m rows.

Research station: Farakoba (West); Saria (western-central) and, Kamboinsé
Farmers field : Po (South) and Manni (northern)

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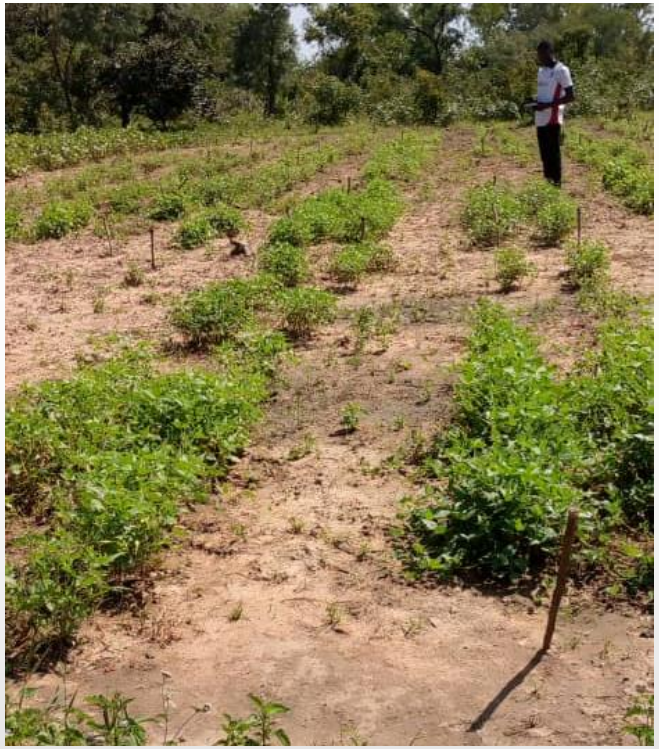
Farako-ba (Bobo Dioulasso, 1200mm)

Date of planting: August, 8th



Tepary bean line at INERA-Farakoba (September, 2023)

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Kamboinsé

Date of planting: August, 17th

Tepary bean line at Kamboinsé research station (2023)

Student recording data on Tepary bean line at Kamboinsé research station (2023)

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Saria(Koudougou)

Date of planting: August, 13rd

Tepary beans lines at maturity in Saria (2023)

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Guiarro (Po)

Date of planting: July, 7th

The high rainfall recorded in Po over a long period coinciding with ripening led to a major impact on harvests. For the coming seasons, we therefore consider it necessary to carry out trials on several dates of planting.

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Conclusion

All the tests scheduled for this year were carried out, in all the locations planned for this purpose. And we'll have to go back to the different sites to collect the harvests in order to assess the yields. The most awaited results are those on the three lines of mung bean (**Ganga1; AVMU1621 and IC-103245)**, which have particularly impressed the inhabitants and farmers of Manni, given the delay in sowing. The two best one will be registered

The first trials on tepary beans will also enable us to define sowing dates in each location.

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Conclusion

Regarding field day, we have decided this year to carry out an evaluation of the mung bean seeds traits that growers are looking for. This follows questions from some farmers about the existence of other colors besides green in mung bean. This will help in future breeding purposes.

Thanks for your attention

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