



Generation of a Agricultural technologies to mitigate climate change
imposed risks to food security in smallholder farming communities in
Western Pacific Countries

EU_ARD Final Workshop



Crop Diversification
**Screening sweetpotato for stress
tolerant**

Background

❑ Drought, Salinity and Excess soil moisture are most serious environmental problem affecting sweetpotato growth and yield in many tropical countries , including Papua New Guinea where it is grown as the number one staple crop under rainfed condition.

❑ Some sweetpotato genotypes survives in such conditions while many others failed. These conditions devastates sweetpotato growth and threatens the livelihood of local farmers.

❑ Different time to maturity and to be fair to the varieties they were grouped according to time to maturity

❑ Research on the above topic remains limited in Papua New Guinea, therefore under the EU_ARD project s, crop diversification component.

❑ About 102 sweetpotato from different NARI established centres were brought together and screen at Bubia between 2012-2015.

❑ Our preliminary study revealed that there are about 59% varieties that can grow and produce tubers between 70-98days under lowland growing conditions and also in low soil moisture conditions

❑ 7 varieties for saline prone areas

Table I. Origin of the cultivars

Origin of cultivars	Total collections/trials
Breeding lines (Aiyura & Bubia)	26
S4Needs selection	30
Highlands landrace	16
PRAP 1 st class Selection	14
Lowland landrace (Atolls & Laloki)	6
Exotic	10
Total collection	102
Number of on station evaluation trials	6

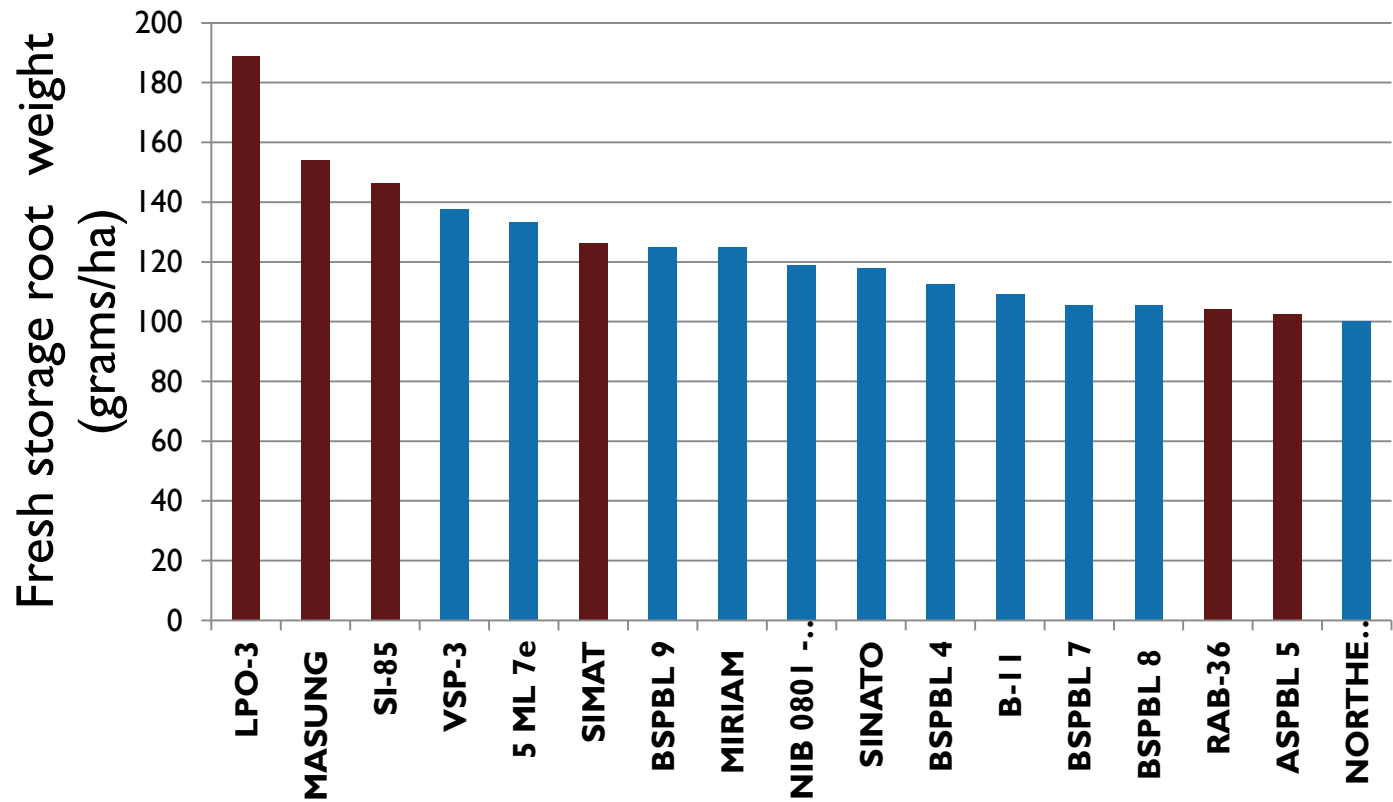
On station evaluation trials



Phenology Groupings

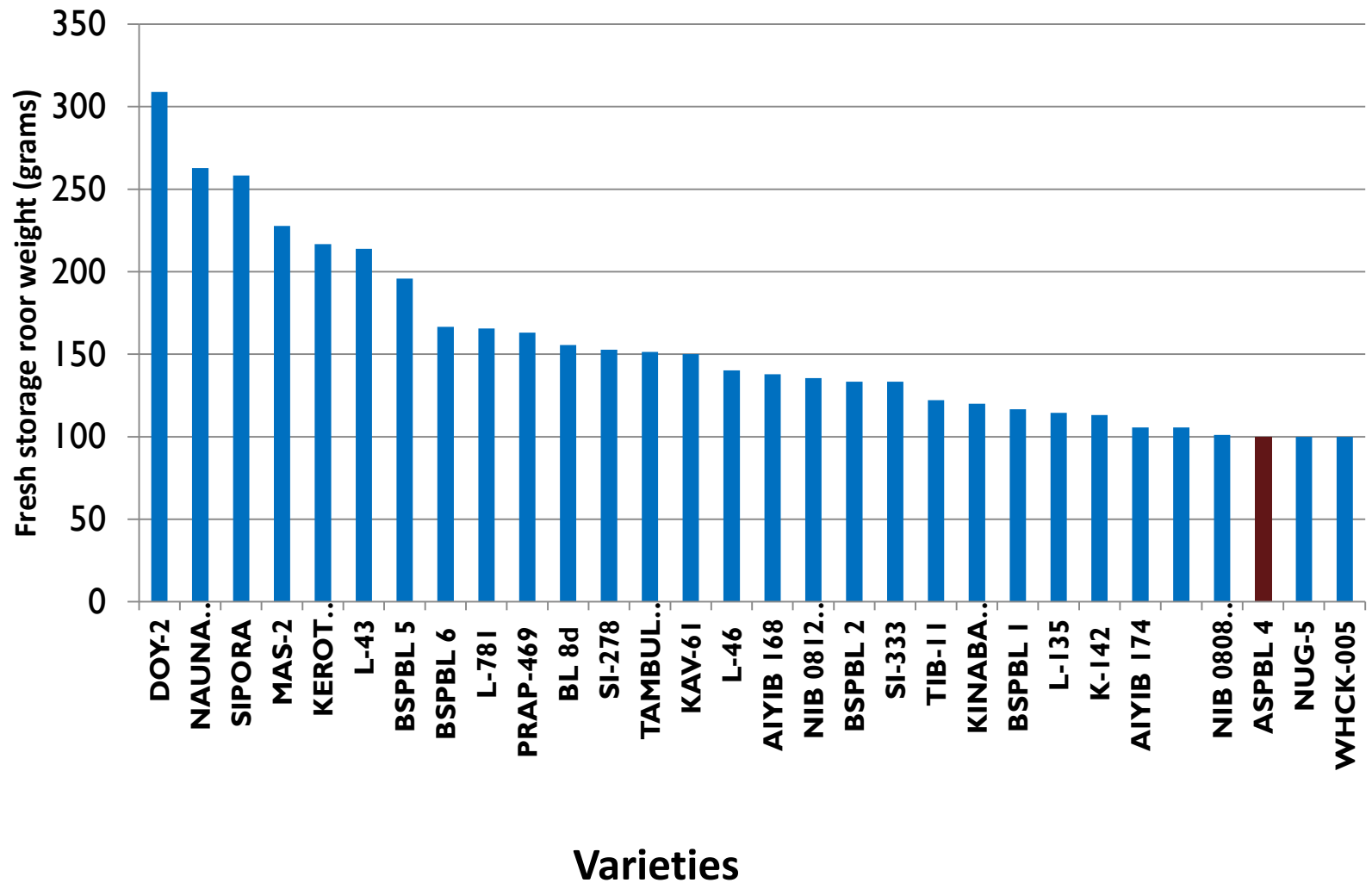
☐ To be fair to the varieties, varieties were grouped according days of maturity at 70, 98 and 126 DAP. Selection was made on (>100grams tubers).

Figure 1. 70 DAP selected lines



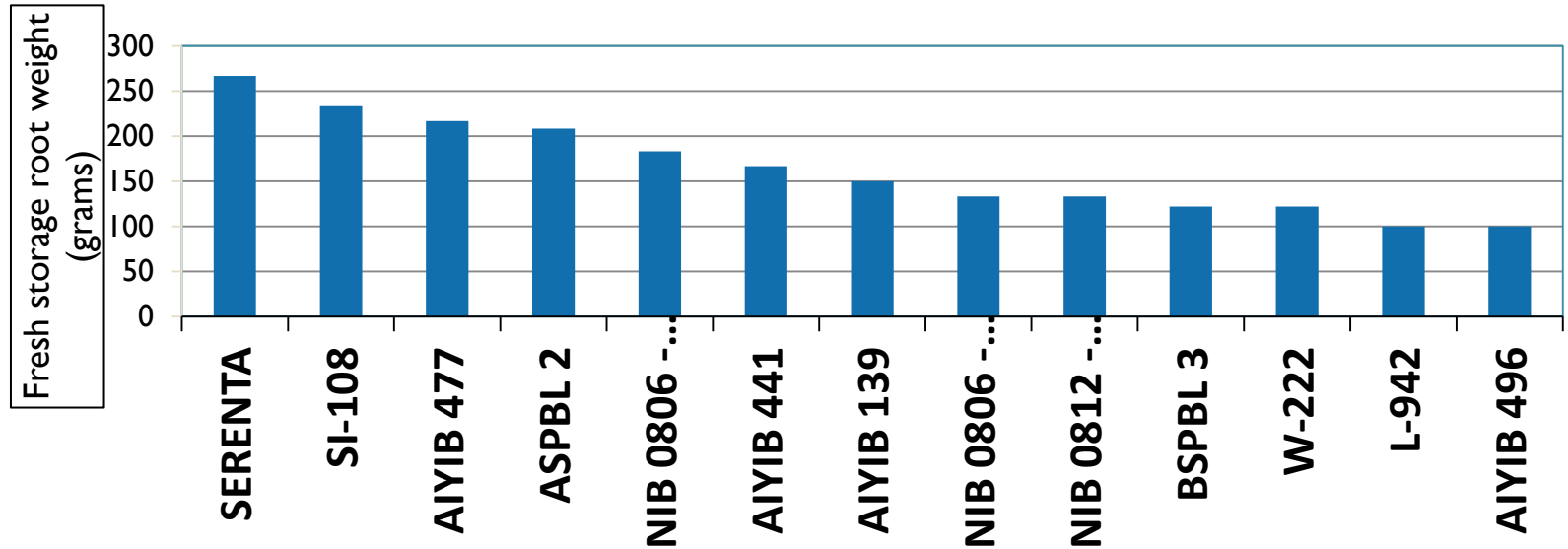
Phenology -continue

Figure 2. 98DAP Selected genotypes



Phenology -Continue

Figure 3. 126 DAP selected genotypes



- ❑ In 70 days 17 varieties were selected comprised of breeding lines, Landraces and exotic lines
- ❑ At 98 days 30 genotypes were selected and Doy -2, Nauna Island and Sipora were the top varieties
- ❑ At 126 days, 13 varieties including Serenta, SI-85, AIYIB 477 and ASPBL 4 were among the top selected genotypes

Selected sweetpotato lines screened for Drought, Salinity and Excess Moisture

- screening and identifying improved drought, salinity and excess moisture tolerant sweetpotato genotypes is of major importance.
- Therefore, to identify drought, salinity and excess moisture drought tolerant genotypes and selection indices such as stress susceptibility index (SSI), mean product (MP), geometric mean product GMP, stress tolerance index (STI), tolerance,



Salinity studies-Preliminary Results

Figure 4. Root length (cm)

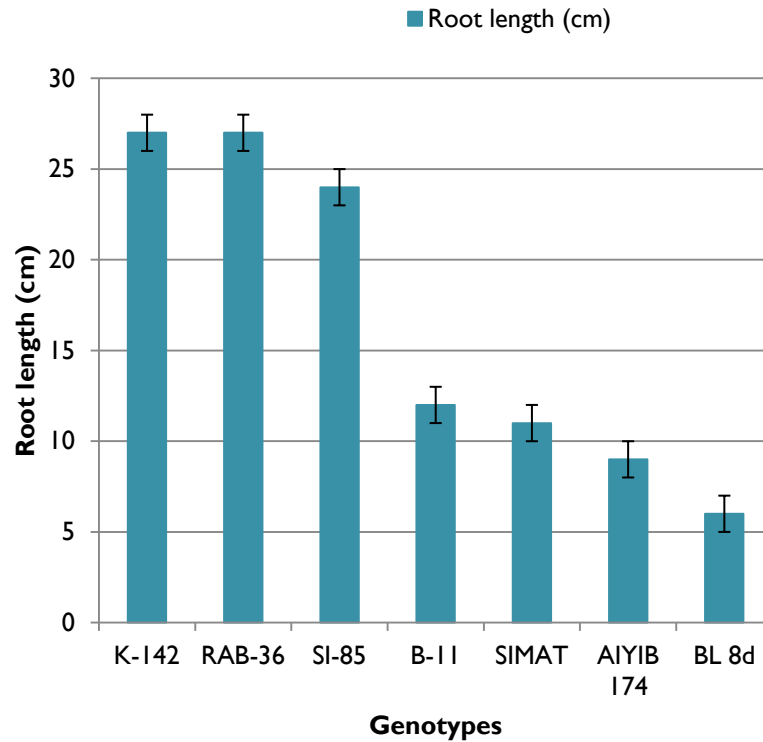
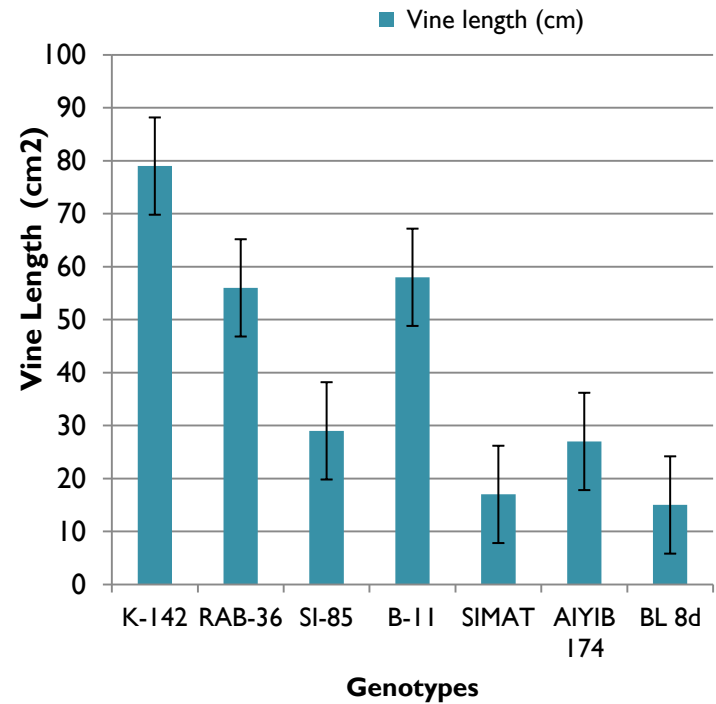


Figure 6. Vine length (cm)



Drought Tolerant lines

Table 2. Stress tolerance indices

Gcode	Genotype	YP	YS	SSI	MP	TOL	STI	GMP
1	MASUNG	288.6	58.2	2.53	<u>173.4</u>	<u>230.4</u>	<u>0.85</u>	<u>129.6</u>
2	SIMAT	262.8	70.6	2.32	166.7	192.2	0.94	136.2
3	AIYIB 174	266	44.8	2.63	155.4	<u>221.2</u>	0.6	109.2
4	BSPBL 2	206.7	90.3	1.78	148.5	116.4	<u>0.94</u>	<u>136.6</u>
5	SINATO	187.2	41.8	2.46	114.5	145.4	0.4	88.5
6	MIRIAM	181.2	21.2	2.8	101.2	160	0.19	62
7	NIB 0801 - 001	199.1	120	1.26	159.6	79.1	<u>1.21</u>	<u>154.6</u>
8	BL 8d	162.3	57	2.05	109.7	105.3	0.47	96.2
9	RAB-36	182.1	30.5	2.64	106.3	151.6	0.28	74.5
10	BSPBL 8	167	33	2.54	100	134	0.28	74.2
11	BSPBL 4	153.5	32.4	2.5	93	121.1	0.25	70.5
12	VSP-3	138.6	37.6	2.31	88.1	101	0.26	72.2
13	K-142	123.3	35.7	2.25	79.5	87.6	0.22	66.3
14	SI-85	107.5	62.6	1.32	85.1	44.9	0.34	82
15	ASPBL 4	106.8	51	1.65	78.9	55.8	0.28	73.8
16	B-11	103.4	1.6	<u>3.12</u>	52.5	101.8	<u>0.01</u>	<u>12.9</u>
17	BSPBL 9	101.7	45.5	1.75	73.6	56.2	0.23	68
18	AIYIB 168	99.7	17.6	2.61	58.7	82.1	0.09	41.9
19	ASPBL 5	77.6	66.6	<u>0.45</u>	72.1	11	0.26	71.9
20	5 ML 7e	64	46	<u>0.89</u>	55	18	0.15	54.3
21	NORTHERN STAR	59	34	1.34	46.5	25	0.1	44.8
22	LPO-3	65.9	20.6	2.18	43.3	45.3	0.07	36.8
23	BSPBL 1	39.3	32.5	<u>0.55</u>	35.9	<u>6.8</u>	0.06	35.7
24	BSPBL 7	30.7	12.7	1.86	<u>21.7</u>	18	<u>0.02</u>	<u>19.7</u>

□ STI, GMP, MP- Genotypes with High values represents drought tolerant and yield potential

□ SSI TOL- high values shows drought susceptible genotypes

Drought studies- continue

- Base on the stress indices we have selected the following varieties for on farm trials (SIMAT, SI-85, MASUNG, ASPBL 4, RAB-36, LPO-3 ,SI- 85, ASPBL 5 and Local cultivar (Yule and Amoron).

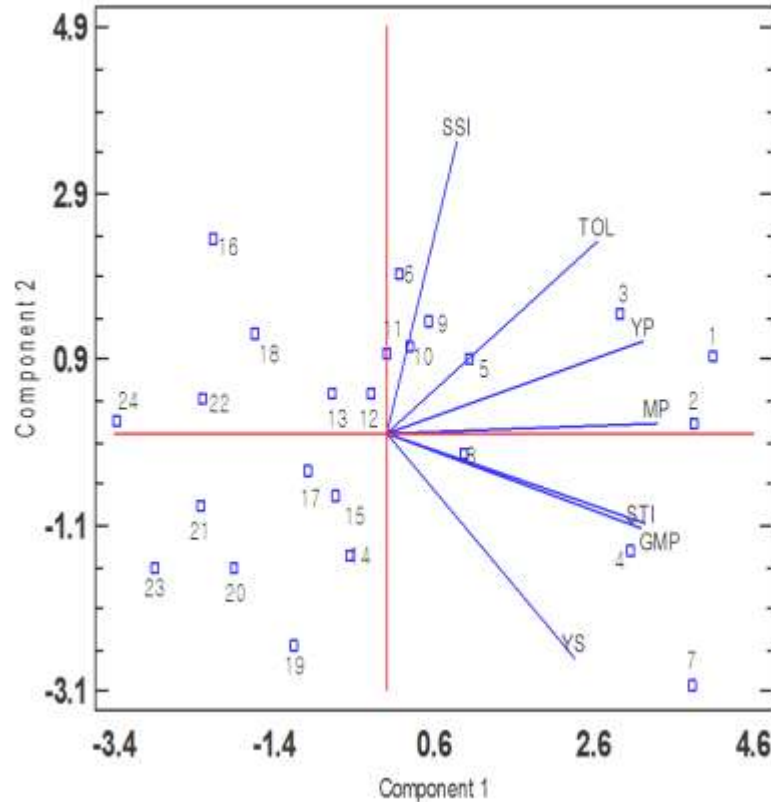


Figure 1. Principle component

irrigated



stress



On Farm trials

Table 3. Yield and Yield components from Yule Island

Variety	Fresh Biomass	HI%	Marketable Yield (t/ha)	Total Yield (t/ha)
SI -85 (3)	13.4 ^a	61.9 ^{ab}	8.8 ^a	11.2 ^a
LPO-3	13.0 ^a	37.2 ^{cd}	5.3 ^{ab}	7.8 ^{ab}
RAB -36 (4)	12.0 ^{ab}	64.2 ^a	7.8 ^a	9.6 ^a
SIMAT (1)	10.6 ^{abc}	45.9 ^{bc}	6.0 ^{ab}	7.3 ^{abc}
YULE ISLAND	8.5 ^{abc}	20.9 ^{de}	2.5 ^{bc}	5.8 ^{abc}
MASUNG (2)	5.5 ^{bc}	21.0 ^e	2.2 ^{bc}	2.7 ^{bc}
ASPBL 4	3.9 ^c	17.0 ^e	1.2 ^{bc}	2.9 ^{bc}
ASPBL 5	3.4 ^c	0.0 ^f	0.0 ^c	1.7 ^c
Mean	8.8	33.5	4.2	6.1
CV %	44.5	40.5	35.7	36.4

- Two on farm trials were established in two different province (Madang & Central).
- Presented here is results from the Hisu and Yule trials
- There was significant differences in the yield components assessed



The varieties SI-85, RAB-36 and SIMAT produces good tuber yield at Yule. This variety shows their adaptability to growing conditions in Yule.

On farm trial -continue

Table 4. Yield and Yield components from Yule Island

Variety	Fresh Biomass	Harvest Index	Marketable Yield (t/ha)	Total yield (t/ha)
SIMAT (1)	382.6 a	13.8 ^a b	17.5 ^a	13.7 ^a
SI- 85 (2)	251.6 ab	29.9 ^a b	14.7 ^{ab}	7.9 ^{ab}
MASUNG (5)	145.0 ab	16.7 ^a b	8.9 ^{abc}	6.5 ^{ab}
ASPBL 4	101.8 ab	0.4 ^b	1.0 ^c	2.3 ^{ab}
RAB -36 (3)	97 ^{ab}	34.9 ^a	7.8 ^{abc}	5.6 ^{ab}
LPO-3 (4)	66.1 ^{ab}	5.8 ^{ab}	4.3 ^{bc}	4.3 ^{ab}
YULE ISLAND	19.6 ^b	7.6 ^{ab}	0.6 ^c	1.1 ^b
ASPBL 5	14.6 ^b	6.8 ^{ab}	1.1 ^c	1.9 ^b
Mean	135	14.5	7.0	5.4

☐ Means with different letters are highly significant

☐ Similar observations were made at Hisu, the lowland varieties SIMAT, SI-85 MASUNG and RAB-36 performs well under dry conditions. The lowest performing lines are breeding lines ASPBL 4 and 5



Conclusion

- ❑ 24 genotypes selected for early maturing and this can be used as a drought coping crops for the lowlands and also highlands
- ❑ 7 varieties were selected for on farm trials with SIMAT, MASUNG, RAB-36 and SI-86 already doing well on farm but trials need to be repeated in the future
- ❑ 7 varieties were preliminary selected for salinity and will require further studies
- ❑ Farmers accepted new varieties and now cultivating some of the new varieties but due to recent drought, farmers lost most of the varieties
- ❑ More work is needed to screen the remaining varieties to stress
- ❑ For these research to benefit the farmers in the wake of current climate change effects, more collaboration is needed and proper instruments is required

Publication

1x Screening sweetpotato for drought tolerant indices – (Scholarly Research Library)

Thankyou

