Evaluation of dual purpose sweetpotato cultivars for root and fodder yields in Eastern Province of Rwanda

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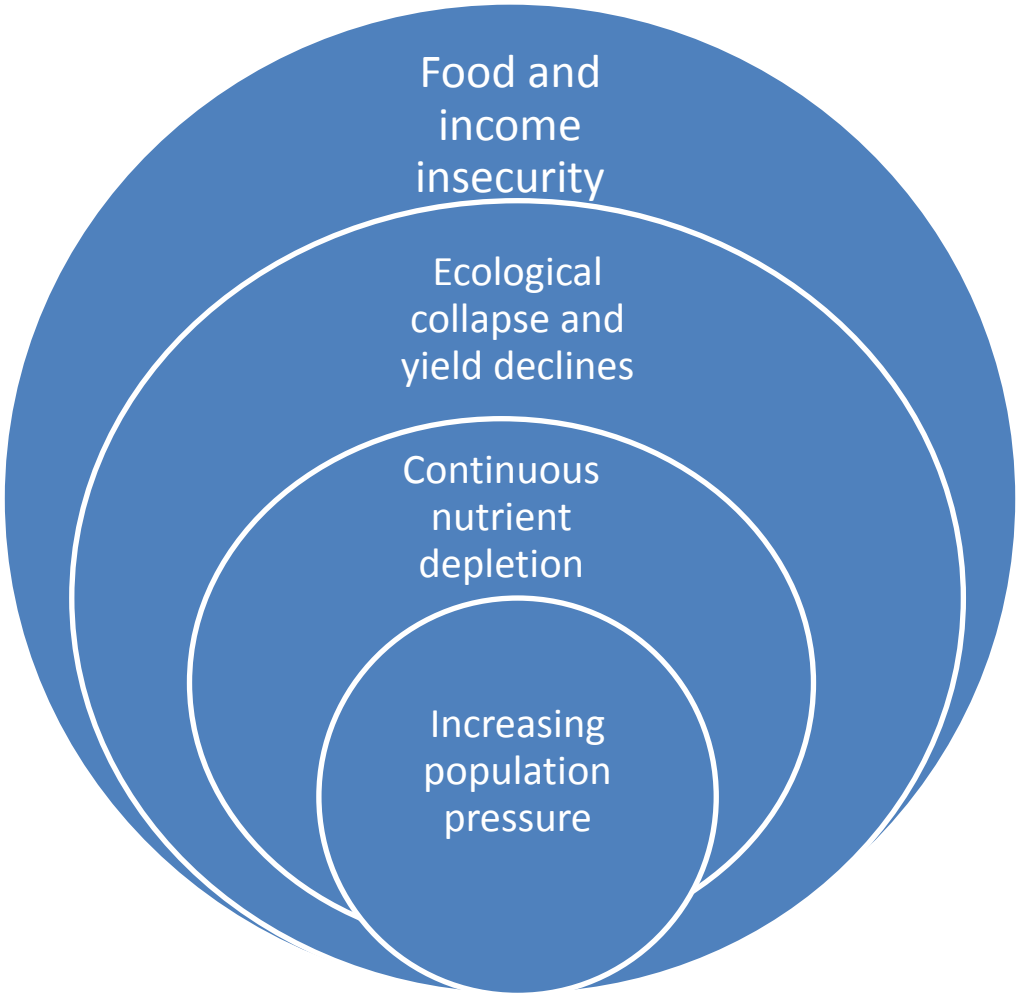
Land and population pressure are the fundamental problems in Rwanda

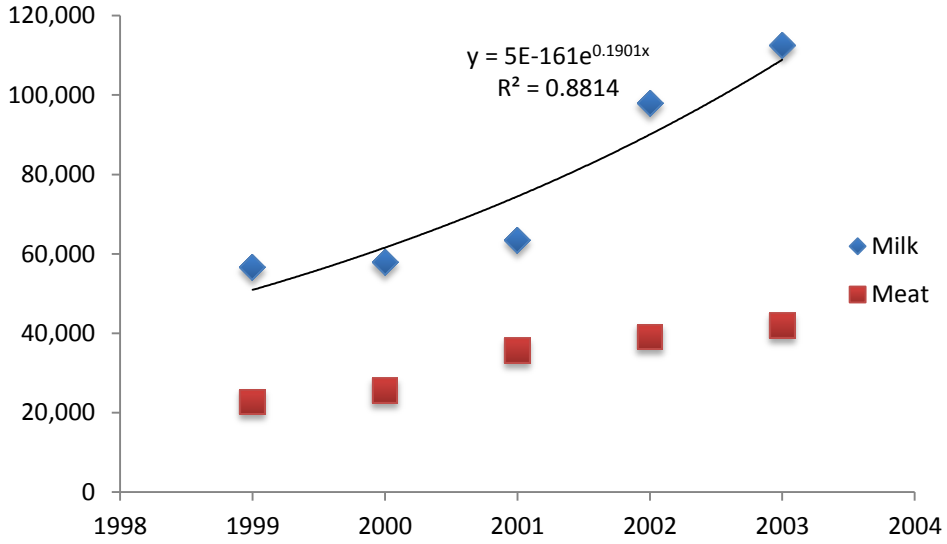
Land size (Hectares)	Number of families	Proportion of total (%)
Less than 0.25	264,835	15
Between 0.25 and 0.50	430,235	25
Between 0.50 and 0.75	282,059	16
Between 0.75 and 1.00	204,446	12
Between 1.00 and 2.00	320 619	18
Between 2.00 and 3.00	78,555	4
Above 3.00	47,462	3

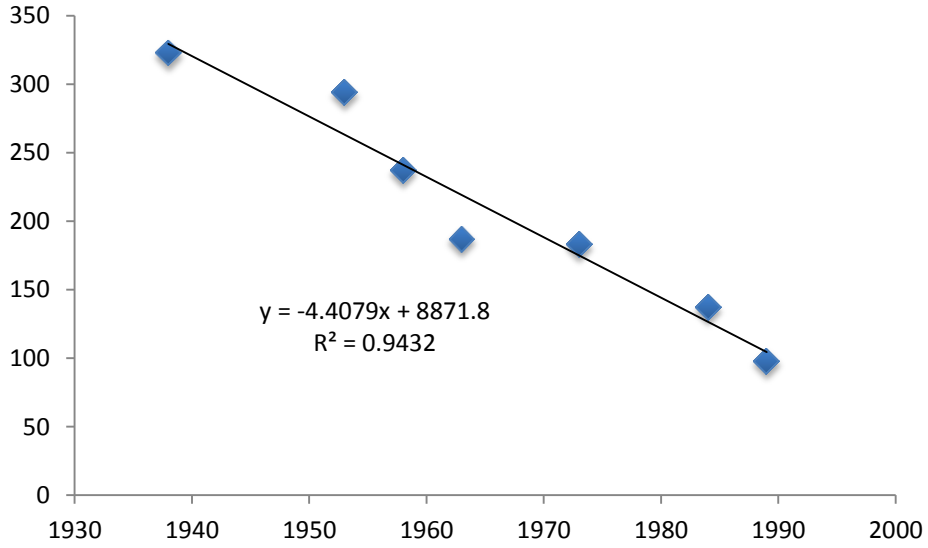
Source:MINECOFIN (2002)

Hierarchy of constraints



- Livestock production and consumption scenario in Rwanda shows that:
  - Demand for livestock products (esp milk) has been increasing by ~20% per annum
  - But the per capita capacity to keep cattle has been declining by > 4 animals per year





Therefore

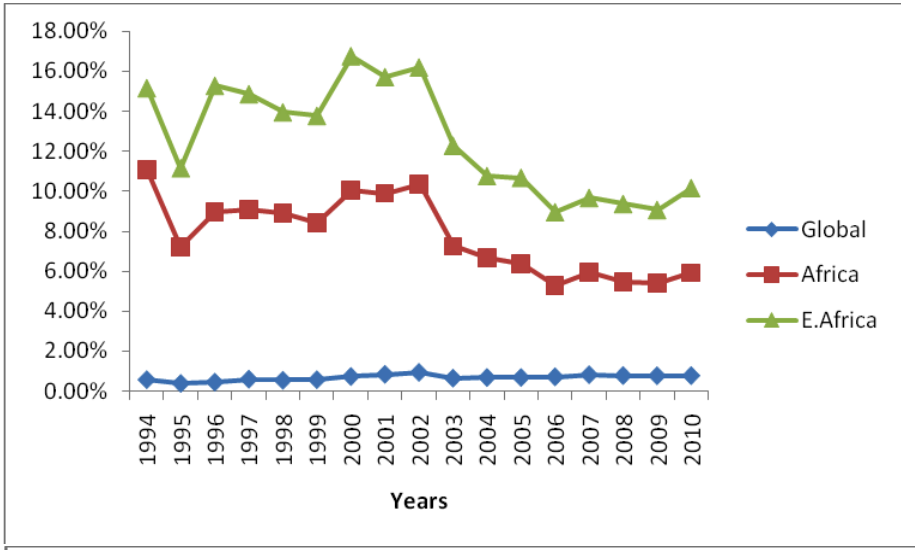
GoR and people of Rwanda have opted for intensification of production; using high biomass food-feed crops to provide technically feasible; environmentally sustainable and socially acceptable options for food nutrition and income security in poor household

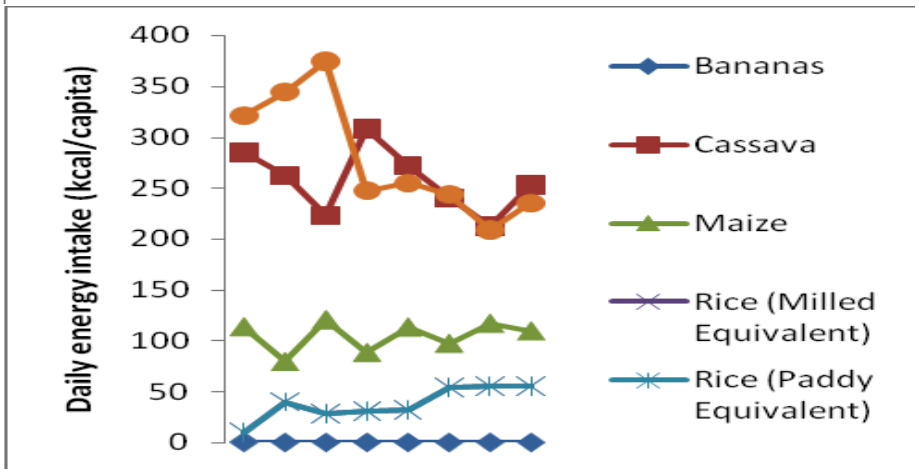
Sweet potato is the choose

because

- Rwanda is a major sweet potato growing country

- The together with cassava they contribute more than grain to per capita caloric intake





Nutrients for some feeds resources compared to Sweetpotato vines

Feeds Type	DM Fraction	ME (Mj/Kg DM)	Crude Protein (g/Kg DM)
Napier Grass	0.17	8.2	128
Maize-beans Mixture	0.61	7.4	133
DP Sweetpotato	0.33	9.0	234

Source: Claessens et al., 2009

Objectives

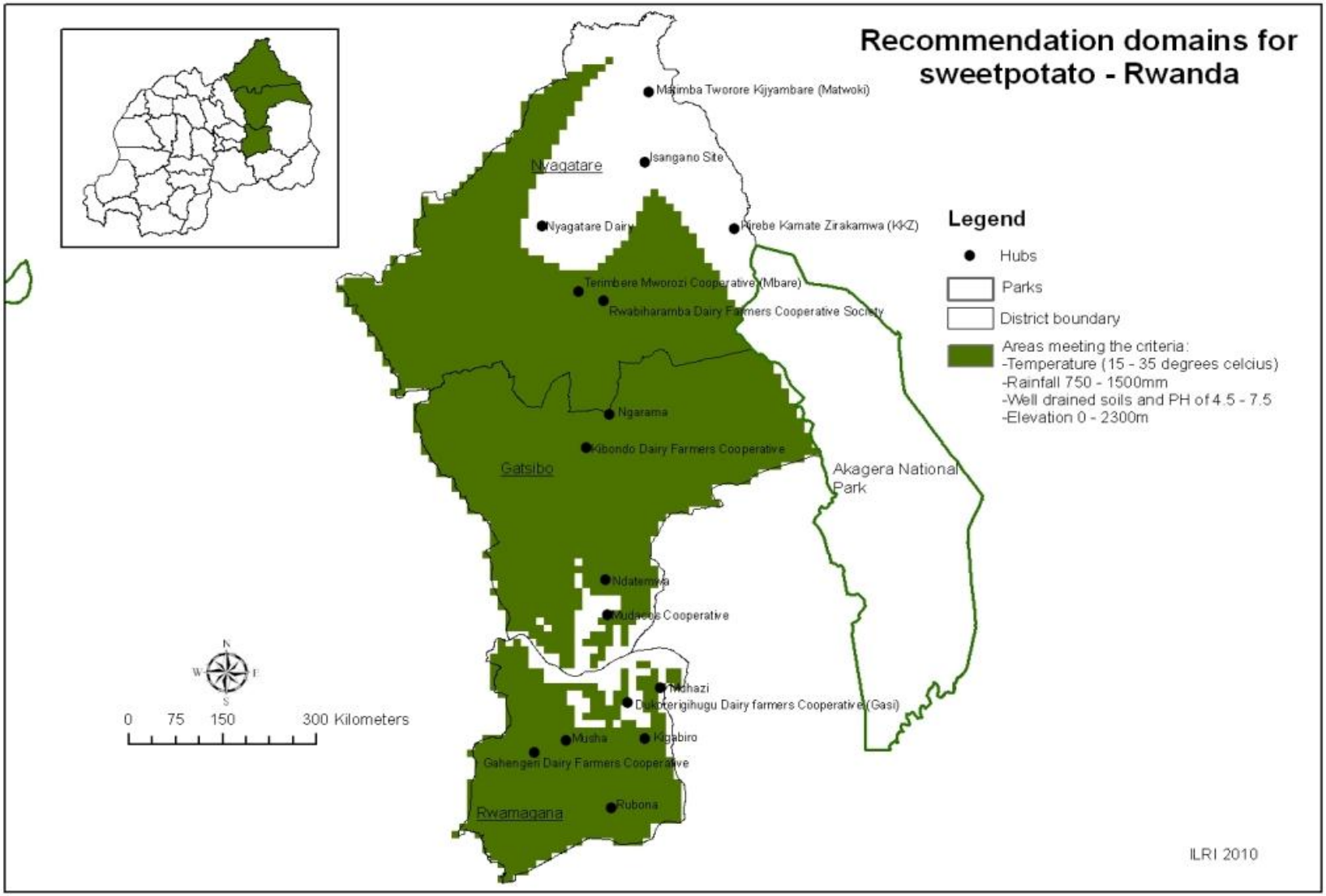
- **Goals:** To increase the contribution of sweet potato to household food, nutrition and income security in Rwanda
- **Purpose:** To identify dual purpose sweet potato cultivars for root-for- food (R4-Food)and vine-for-feed(V4-Feed) production in Rwanda
- **Specific Objectives:**
  - To determine the effect of cutting regimes on DM yield of selected Sweet potato Cultivars
  - To determine effects of cutting management on promising dual purpose sweet potato cultivars in nutritional characteristic of the roots and vines.
  - Enriching the national feed database with Dual Purpose Potato as an important item in the national feed resource inventory

Expected Research outputs

- Recommended Varieties for dualpurpose Production of food and feed
- Recommended cutting regimes of each dual purpose variety for each agro-ecological District
- Known Nutrient composition for each dual purpose variety as inputs in least cost feed formulation using sweetpotato as ingredient.

Materials and Methods…

Study areas


Recommendation domains for sweetpotato - Rwanda
Matimba Tworore Kijyambare (Matwoki)
Isangano Site
Nyagatare
Nyagatare Dairy
Pirebe Kamate Zirakamwa (KKZ)
Terimbere Mworozi Cooperative (Mbare)
Rwabiharamba Dairy Farmers Cooperative Society
Ngarama
Kibondo Dairy Farmers Cooperative
Gatsibo
Akagera National Park
Ndatemwa
Mudacyu Cooperative
Nkhazi
Dukoterigihugu Dairy farmers Cooperative (Gasi)
Musha
Kigabiro
Gahengeri Dairy Farmers Cooperative
Rwamagana
Rubona
Legend
Hubs
Parks
District boundary
Areas meeting the criteria:
-Temperature (15 - 35 degrees celcius)
-Rainfall 750 - 1500mm
-Well drained soils and PH of 4.5 - 7.5
-Elevation 0 - 2300m
N
W
E
S
0 75 150 300 Kilometers
ILRI 2010

...Materials and Methods...

Nyagatare

Nyabitekeri

Karangazi

Kibondo

Gatsibo

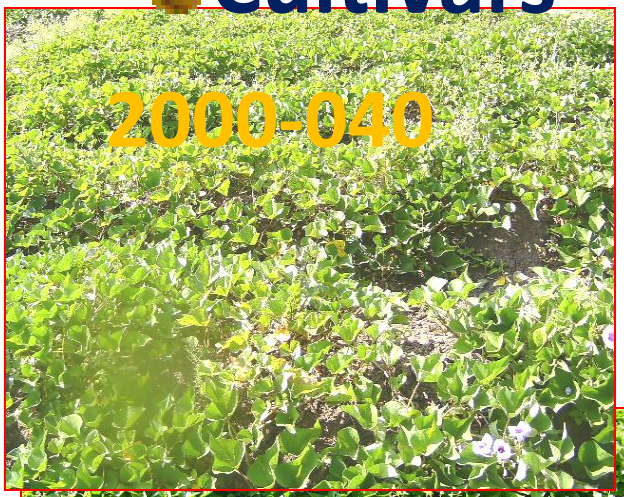
Rwamagana

Study sites

District	Division	EADD Hub	Production system	Weather
	Locality	Hubs	Production system	Moisture
Nyagatare	Nyabitekeri	Nyagatare	Agro-Pastoral system	wet
	karangazi	Karangazi	Largely pastoral S.	Dry
	Rutare	Nyagatare	Agro-pastoral S.	Dry
Gatsibo	Kibondo	Kibondo	Agro-Pastoral	Dry
	Ngarama	Nyagihanga	Agro-Pastoral	Wet
	Kabarore	Kibondo	Agro-Pastoral	Dry
Rwamagana	Muhazi	Kigabiro	Semi-intensive	Wet
	Rutonde	Kigabiro	Semi Intensive	Dry
	Munyiginya	Munyiginya	Intensive	Dry

…Materials and Methods…

Cultivars



Cultivar characteristics

Name	Dry matter (t/ha)	Flesh color	Research station
Kwezikumwe	6.9	Cream-fleshed	Rubona
Mugande,l	5.6	White-fleshed	Rubona, karama
Cacaerpedo	3.9	Orange-Fleshed	Rubona
Kakamega	4.4	Yellow	Rubona and Karama
Naspot	2.2	Cream-Fleshed	Rubona and Karama
2002-155	5.0	Yellow-fleshed	Rubona
2002-154	4.2	Yellow-fleshed	Rubona
2000-040	3.7	Orange-Fleshed	Rubona

Experimental design and data analysis

- **Experimental design:** Split-plot design: Cultivars (main plot) and cutting management (sub-plots) replicates: 3 reps per farm, 3 farms per district
- **Background Parameters**:
  - Soil types (pH, texture, OM, N, P, K)
  - historical weather (rainfall, temperature (mini-max), humidity

…Materials and Methods…

Biological parameters

Agronomic

- Biomass (DM yeilds)
- Nutritional
  - Proximate analysis (NIRS-ILRI AddisAbaba)
  - *In vitro* degradability kinetics at Rubona research station

Results and Discussion…

Root yields on ratooned and intact (unratooned) sweetpotato vines

Cultivar	Intact	SE	Ratooned	SE	Means	SE
2000-040	505.9	188.3	283.6	210.5	394.6[ab]	147.2
2002-154	334.0	121.5	328.9	116.8	331.6[b]	81.3
2002-155	404.5	10 8.7	368.3	112.5	386.4[ab]	78.2
Cacaerpedo	731.7	85.9	616.4	87.8	674.1[a]	61.4
Kakamega	614.4	91.9	716.6	91.9	665.5[a]	64.9
Kwezikumwe	664.2	87.7	674.6	85.9	669.1[a]	61.4
Mugande	557.9	85.9	674.2	87.7	626.1[ab]	61.4
NASPOT1	664.3	85.9	609.8	85.9	637.1[a]	60.8
Cutting Management means						

Vine biomass yields of selected sweetpotato varieties

Cultivar	Intact	SE	Ratooned	SE	Means	SE
2000-040	347.6	236.7	600.8	236.7	474.4^{c}	167.4
2002-154	452.1	146.8	808.6	176.4	630.0^{bc}	114.8
2002-155	703.9	146.8	1035.5	146.8	869.7^{ab}	103.8
Cacaerpedo	429.9	110.4	987.4	108.1	708.7^{abc}	77.2
Kakamega	573.6	115.5	999.8	115.5	786.7^{abc}	81.7
Kwezikumwe	422.7	112.8	1029.7	108.0	726.2^{abc}	78.1
Mugande	733.3	108.0	1363.7	108.0	1048.5^{a}	76.4
NASPOT1	472.1	108.0	905.2	108.0	688.6^{bc}	76.4
Cutting Management	509.9^{b}	56.1	997.4^{a}	56.9		

Root to vine ratios (RVR) of selected sweet potato cultivars

Cultivar	Intact	SE	Attributes	Ratooned	SE	Attributes	Variety Means
2000-040	3.86	0.491	**R**	1.522	0.549	**DP**	2.259[a]
2002-154	0.934	0.317	**F**	1.736	0.366	**DPR**	0.755[bc]
2002-155	1.833	0.304	**DPF**	1.628	0.317	**DPR**	1.223[abc]
Cacaerpedo	1.906	0.229	**DPR**	1.302	0.229	**DPF**	1.337[abc]
Kakamega	1.388	0.245	**DPF**	1.201	0.239	**DPF**	1.110[abc]
Kwezikumwe	1.987	0.234	**DPR**	1.218	0.22	**DPF**	1.404[abc]
Mugande	0.825	0.224	**F**	1.669	0.224	**DPR**	0.717[c]
NASPOT1	1.981	0.224	**DPR**	1.219	0.224	**DPF**	1.401[abc]
Mean R/V	***1.84***	***0.28***		***1.43***	***0.29***		
Classification	***R***	***F***	***DPR***	***DPF***	***DP***		

Main effects of variety on chemical composition of sweet potato vines

Cultivar	OM	CP	NDF	ADF	ADL	ME
Mugande	84.4a	20.4	32.7b	23.6b	5.5	7
Cacaerpedo	83.8ab	20.4	33.1b	23.7b	5.5	7
2002-154	83.2b	19.1	33.4a	24.4ab	5.7	7
NASPOT1	84.8a	20.4	31.7c	24.1b	6	7
Kwezikumwe	84.3ab	19.5	33.7b	24.7a	6	7
Kakamega	84.2ab	20.3	32.8b	24.7a	6.1	7
2002-155	83.7ab	20.0	33.4a	24.7a	6.2	7
2000-040	83.2b	19.0	34.7a	25.5a	6.4	7

Chemical composition (%) and metabolisable energy (MJ/kg DM) in selected SP Roots

Cultivar	OM	N	CP	NDF	ADF	ADL	ME
2000-040	92.7±2.6	1.7±0.47	9.8±2.95	35.5±1.18	22.5±1.06	4.9±0.97	11.7±1
2002-154	91.8±2.4	1.7±0.43	10.1±2.74	36.8±1.09	24.6±0.99	5.7±0.90	11.1±1
2002-155	90.3±2.6	2.0±0.46	12.1±2.95	35.7±1.17	25.5±1.06	6.8±0.97	10.4±1
Cacaerpedo	90.4±2.4	2.2±0.42	12.9±2.67	35.7±1.06	23.7±0.96	5.5±0.88	10.2±1
Kakamega			11.1±2.44	36.1±0.9	24.1±0.8	5.5±0.80	11.0±1

Gas production level in volume (ml/Kg DM) for dual purpose cultivars

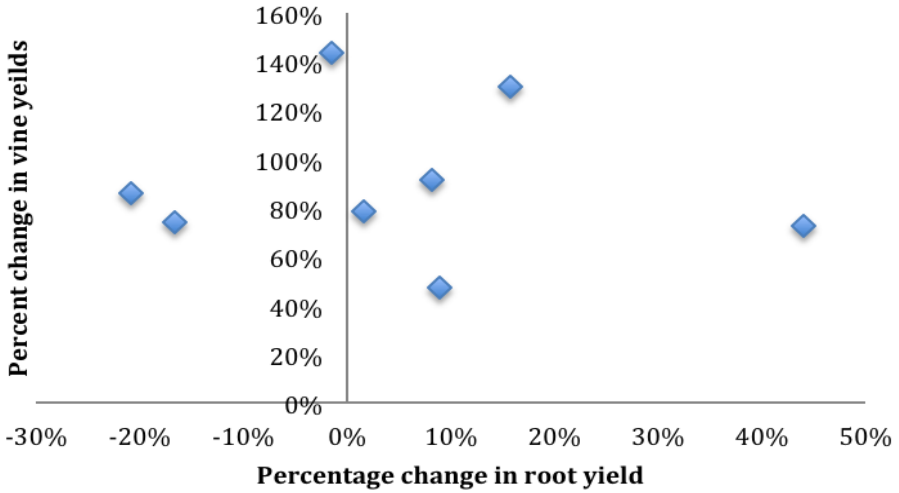
Cultivar	Gas volumes (mL)				Retention Time	
	A	**B**	**k**	**PD**	**$T_{1/2}$**	**RT**
2000-040	**132**	**39**	**0.05**	**169**	**4**	**20**
2002-154	**113**	**77**	**0.06**	**190**	**4**	**18**
2002-155	**107**	**22**	**0.05**	**129**	**4**	**22**
Cacaerpedo	**104**	**69**	0.07	**173**	**3**	**15**
Kakamega	**125**	**71**	**0.05**	**196**	**4**	**19**
Kwezikumwe	**149**	**74**	**0.04**	**71**	**4**	**27**
Mugande	**112**	**73**	**0.05**	**185**	**4**	**19**
NASPOT1	**134**	**64**	**0.07**	**198**	**3**	**15**

DISCUSSIONS

- Low root yields; likely attributed to:
  - Low altitude in Rwanda (Ndirigwe et all, 2004)
  - Climate stress during the growing period
  - Quality attributes of young vines (Villamayor and Perez 1988) that we had to use because of shortage of vines

Relationship between root and vine yields

- Low vine yield in intact plots
- Doubling of vine yield without associated root yield
- What does ratooning do the phenology to the phenology and physiology of the crop?



Conclusions and recommendations

- All the eight cultivars were dual purpose sweet potato; especially when subjected to strategic ratooning regimes. Rapid multiplication distribution of vines of these cultivars is recommended
- Harvesting two times at 80 interval does not affect root yield but increases vine yields. Therefore it is the recommended ratooning regime in sweetpotato R4-Food and V4-Feed in Eastern Province of Rwanda

- Root yields in were low. While these could be attributed to a number of experimental management factors; there is need to examine the effect of improved soil fertility in sweet production R4-Food and V4-Feed
- A number of inconsistencies have been reported on the effect of vine cutting on root and cumulative vine biomass yields. Lack of expected reduction of root yield when vine yield is phenomenally increased, insinuates some compensatory mechanism in nutrient dynamics under ratooning regimes. Further studies are recommended.

Lessons learnt

- Partnership among stakeholders
- Right variety
- Proper skills communication

Acknowlegements

- CIP (SASHA)
- RAB
- University of Nairobi
- EADD
- Dairy Cooperative Members
- Every one of us

Thank you for listening.
It is discussion time now!