Yield Performance of Sweet Potato as an Alternative Agriculture Enterprise for Delaware' s Underserved Growers

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Introduction

- The sweet potato (*Ipomoea batatas*) is a dicotyledonous plant that belongs to the family convolvulaceae
- Evolved in tropical America
- Need frost-free growing season of five months
- Rich source of carbohydrates and vitamins including A (beta carotene)
- NC, Louisiana are the great state in USA and average US yield is 27478 kg/ha^{-1}
- China is the largest producers
- It can be grown during drought condition with minimum input

- Leaf, root can be eaten and it is staple food in many parts of the world and industrial crop in developed world (energy crops too).
- It is a crop of 500 millions dollars worth in the USA and produced
- almost 26.5 millions cwt in 2013 (NASS 2013).
- World harvested 2.8 billion cwt and US contribution is nearly 1 %.
- China produces almost 81% of world production.
- It is a nice crop from food security and hunger point of view because a hectare of sweet potato can feed more people than a hectare of cereal grains, with less energy input (Patterson, 1979).

US Sweet Potato Production

The goal is to help underserved community introducing sweet potato as an alternative agriculture enterprise that improves income and nutrition in the context of climate change.

Specific objectives:

- Conduct field research to evaluate sweet potato cultivars in Delaware conditions.
- Reach out clientele with results through various extension methods.

Comparative study of profitability

Sweet potatoes -For Fresh Market

Estimated Costs and Returns Per Acre

	unit	Quantity	Price or Cost /Unit	Total/Acre ($)	Your Farm
1. Gross Receipts	cont	530	13	6890	
2. Variable costs					
Transplants	Thou.	17	29	493	
Transplant labor	Hrs	10	10	100	
Irrigation, Machinery & labor	Acre	1	85	85	
Harvest labor	hrs	40	10	400	
Curing and storage	cont	530	1.25	662.5	
Boxing	cont	530	1.75	927	
marketing	cont	530	0.75	398	
interest on op cost		3065	5%	153.25	
3. Total Variable costs				3218	
4. Fixed costs					
Tractor/Machinery	acre	1	190	190	
Irrigation	acre	1	75	75	
Total Fixed costs				265	
5. Other costs					
Land rent	acre	1	50	50	
General overhead	DOL	3218	7%	225.26	
Total other costs:				275.26	
6. Total costs:				3758.26	
7. Net returns to risk and Management				**$3,131**	

CORN GRAIN, CONVENTIONAL NON-IRRIGATED PER ACRE FOR				2015
ITEM	UNIT	QUANTITY	PRICE	TOTAL
GROSS INCOME				
CORN GRAIN	BUSHEL	150	$4.00	$600.00
VARIABLE COSTS				
SEED	1000 SEEDS	32	$1.56	$49.92
SOIL TEST	ACRE	1	0.30	0.30
NITROGEN	POUND	150	0.52	78.00
PHOSPHATE	POUND	30	0.59	17.70
POTASH	POUND	60	0.37	22.20
LIME	TON	0.5	45.00	22.50
LUMAX	QUART	2.5	13.25	33.13
ATRAZINE	QUART	0.5	4.00	2.00
CROP INSURANCE (RP 75%)	ACRE	1	25.49	25.49
DRYING FUEL	BUSHEL	150	0.36	54.00
INTEREST ON OPERATING CAPITAL	$225.75	0.5	8.5%	9.59
TOTAL VARIABLE COSTS LISTED ABOVE				$314.83
FIXED/OVERHEAD COSTS (CUSTOM RATES ARE USED AS A PROXY FOR FIELD OPERATION COSTS)				
CHISEL PLOWING	ACRE	1	$19.36	$19.36
DISKING	ACRE	1	22.61	22.61
FIELD CULTIVATOR/FINISHER	ACRE	1	17.70	17.70
FERTILIZER SPREADING	ACRE	1	8.28	8.28
PLANTING WITH FERTILIZER	ACRE	1	17.35	17.35
NITROGEN APPLICATION	ACRE	1	10.63	10.63
PESTICIDE APPLICATIONS	ACRE	1	9.07	9.07
HARVESTING	ACRE	1	30.82	30.82
HAULING	BUSHEL	150	0.19	28.50
INTEREST ON SPRING CUSTOM CHARGES	$105.00	0.5	8.5%	4.46
LAND CHARGE	ACRE	1	98.00	98.00
TOTAL FIXED COST LISTED ABOVE				$266.78
TOTAL VARIABLE AND FIXED COST LISTED ABOVE				$581.61
NET INCOME OVER VARIABLE & FIXED COSTS LISTED ABOVE				$18.39

Contd. comparative study of profitability

CORN GRAIN, NO-TILL NON-IRRIGATED	PER ACRE FOR			2015
ITEM	UNIT	QUANTITY	PRICE	TOTAL
GROSS INCOME				
CORN GRAIN	BUSHEL	150	$4.00	$600.00
VARIABLE COSTS				
SEED RR	1000 SEEDS	32	$3.32	$106.24
SOIL TEST	ACRE	1	0.30	0.30
NITROGEN	POUND	150	0.52	78.00
PHOSPHATE	POUND	30	0.59	17.70
POTASH	POUND	60	0.37	22.20
LIME	TON	0.5	45.00	22.50
LUMAX	QUART	2.5	13.25	33.13
ATRAZINE	QUART	0.5	4.00	2.00
ROUNDUP	QUART	1	5.50	5.50
CROP INSURANCE (RP 75%)	ACRE	1	25.49	25.49
DRYING FUEL	BUSHEL	150	0.36	54.00
INTEREST ON OPERATING CAPITAL	$287.57	0.5	8.5%	12.22
TOTAL VARIABLE COSTS LISTED ABOVE				$379.28
FIXED/OVERHEAD COSTS (CUSTOM RATES ARE USED AS A PROXY FOR FIELD OPERATION COSTS)				
FERTILIZER SPREADING	ACRE	1	8.28	8.28
NO-TILL PLANTING WITH FERTILIZER	ACRE	1	19.30	19.30
NITROGEN APPLICATION	ACRE	1	10.63	10.63
PESTICIDE APPLICATIONS	ACRE	1	9.07	9.07
HARVESTING	ACRE	1	30.82	30.82
HAULING	BUSHEL	150	0.19	28.50
INTEREST ON SPRING CUSTOM CHARGES	47.28	0.5	8.5%	2.01
LAND CHARGE	ACRE	1	98.00	98.00
TOTAL FIXED COST LISTED ABOVE				$206.61
TOTAL VARIABLE AND FIXED COST LISTED ABOVE				$585.89
NET INCOME OVER VARIABLE & FIXED COSTS LISTED ABOVE				$14.11

SOYBEANS RR READY	PER ACRE FOR			2015
ITEM	UNIT	QUANTITY	PRICE	TOTAL
GROSS INCOME				
SOYBEANS	BUSHEL	40	$9.54	$381.60
VARIABLE COSTS				
SEED	1000 SEEDS	150	$0.36	$54.00
SOIL TESTING	ACRE	1	0.30	0.30
PHOSPHATE	POUND	45	0.59	26.55
POTASH	POUND	40	0.37	14.80
LIME	TON	0.5	45.00	22.50
GRAMOXONE INTEON	PINT	2	3.37	6.74
ROUNDUP	QUART	1	5.50	5.50
WARRIOR	OUNCE	3	2.34	7.02
CROP INSURANCE (RP 75%)	ACRE	1	14.90	14.90
INTEREST ON OPERATING CAPITAL	$137.41	0.5	8.5%	5.84
TOTAL VARIABLE COSTS LISTED ABOVE				$158.15
FIXED/OVERHEAD COSTS (CUSTOM RATES ARE USED AS A PROXY FOR FIELD OPERATION COSTS)				
FERTILIZER APPLICATION	ACRE	1	8.28	8.28
SOYBEAN - NoTill	ACRE	1	19.38	19.38
PESTICIDE APPLICATIONS	ACRE	3	9.07	27.21
HARVESTING	ACRE	1	30.93	30.93
HAULING	BUSHEL	40	0.19	7.60
INTEREST ON SPRING CUSTOM CHARGES	$54.87	0.5	8.5%	$ 2.33
LAND CHARGE	ACRE	1	98.00	98.00
TOTAL FIXED COST LISTED ABOVE				$193.73
TOTAL VARIABLE AND FIXED COST LISTED ABOVE				$351.88
NET INCOME OVER VARIABLE & FIXED COSTS LISTED ABOVE				$29.72

Material and methods

- RCBD
- Plot size 5’x25’
- Clay loam with pH 6.8
- No use of any chemicals
- Date of planting June 12
- Harvested on October 16
- Sampling area 11.6 m square
- Slips size 8-10” , plant to plant 1’

Land preparation and plantation

Layout

Expt. Design: RCBD with four variety replicated

Growth and Development

Preparation of harvesting

Harvesting contd.

Harvesting contd.

Harvesting contd.


Cloverland Dairy
HY-POINT DAIRY

Storage


Cloverland Dairy
MISUSE PUNISHABLE BY LAW
Cloverland Dairy
MISUSE PUNISHABLE BY LAW
GARELICK FARMS
Cloverland Dairy
MISUSE PUNISHABLE BY LAW
Cloverland Dairy
MISUSE PUNISHABLE BY LAW


T1-R1
A-193-217

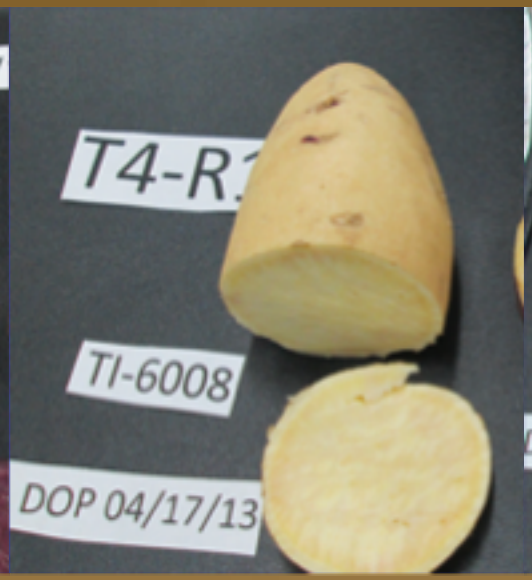

DOP 04/17/13
T2-R1


TI-6008
DOP 04/17/13


T6-R1
TU1-001
DOP 04/17/13


T1-R1


DOP 04/17/13
T2-R1


TI-6008
DOP 04/17/13


T6-R1
TU1-001
DOP 04/17/13

Table 2. Mean yield of four sweet potato varieties in 2012, 2013 and 2014.

Varieties	Mean yield, (kg ha^{-1})			
	2012	2013	2014	Average yield (kg ha^{-1})
A-193-217 (V1)	31934ab	32168ab	22702c	28935ab
Birmingham (V2)	22910b	39138a	42453a	34833a
TI-6008 (V4)	44157a	17852b	17436c	26481b
TUI-001(V6)	26837b	32662a	36043ab	31847ab
Lsd cv	13204 21	14329 23.5	15919 26.8	7201 23.8

S. potato chips

Baked potato with maple cinnamon butter

S. potato fries

Rainfall distribution in inch during growing season in 2012,013, and 014 in Smyrna

Years	May	June	July	August	Septe	October	Total Rainfall in inches
2012	0.81	2.42	1.47	3.61	4.35	9.98	22.64
2013	3.67	11.78	8.09	4.7	1.43	4.13	35.80
2014	4.56	5.03	3.67	4.6	2.32	3.46	23.64

Figure 1: Rainfall distribution in Smyrna during sweetpotato growing season of 2012, 013, and 014

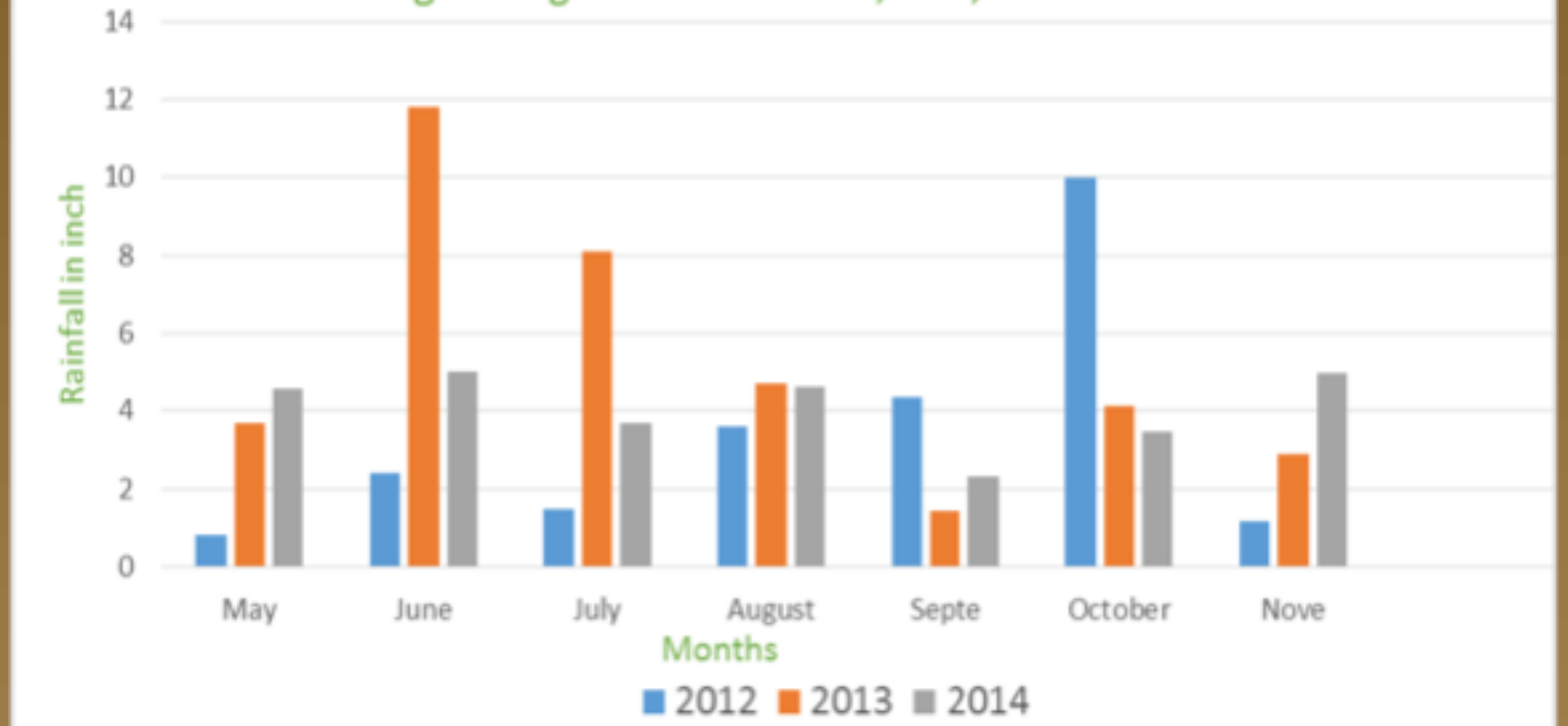


Table 3. ANOVA in year wise analysis

Source of variance	df		----------Years----------					
			2012		2013		2014	
		Mean sq	F	Pr>F	F	Pr>F	F	Pr>F
model	5	178318624	4.08	0.05	3.01	0.10	3.87	0.06
rep	2	61957612.5	1.42	0.31	0.47	0.64	0.16	0.85
var	3	255892631	5.86	0.03	4.7	0.05	6.34	0.02
error	6	43677602						
total	11							

Table 4. ANOVA in combined analysis

Source of variance	df	Mean sq	F	Pr>F
model	17	171351274	3.24	0.0087
yr	2	9772335	0.18	0.83
Rep(yr)	6	32165611	0.61	0.72
var	3	117572097	2.22	0.12
Yr*var	6	391286171	7.4	0.0004
error	18			
total	35			

Recommendations

- These varieties performed well in Delaware climate since they yield higher than US average in sweet potato yield. Us average yield in 2012 and 2013 were 26223 kg ha^{-1} and 27478 kg ha^{-1} respectively.
- Good crop in crop rotation to utilize nutrients left by previous crops like vegetables
- No need high inputs
- Suppress weeds by its canopy
- Can be planted in drought prone area too

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References

Ag Marketing Resource Center.
http://www.agmrc.org/commodities__products/vegetables/sweet-potato-profile/

NASS, 2013

Thank You for Your Presence