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Economics Analysis of Snake Tomato Production Cropped in a Three and Four Years Old (Existing) Rubber Plantation Treated With Rubber Effluent and NPK

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ABSTRACT

The significant drop in rubber production in Nigeria, has been attributed to the withdrawal of the Small holder rubber farmer that account for over 75% of rubber production due to the income gap created by the long gestation period of rubber (5-7years) amidst other agronomic challenges. To return them back to production, there is the need for appropriate agronomic system that will incorporate rubber with short duration marketable and important arable crop that will serve as a source of additional income to bridge the income gap and also take care of other agronomic challenges associated with rubber production. Hence this study tends to look at the profitability of intercropping snake tomato with rubber using rubber effluent and NPK as soil amendments in a three and four years old rubber plantation. The experiment was carried out in 2018 and 2019 cropping seasons at the research plantation of rubber research institute of Nigeria, Iyanomo, Edo State. The treatments involved sole rubber and snake tomato and their intercropped combination with NPK and rubber effluent application laid out in a randomized complete block design in three replicates. Data were collected on fruit yield. The economic analysis of the trials was carried out by partial farm budgeting. The results showed that NPK and rubber effluent application had significant effect on the yield of snake tomato (P<0.05). The highest fruit yield was observed in rubber snake tomato intercrop treated with 60 kg N ha-1 of NPK 15:15:15 (RSNPK). Increase in rubber effluent application rate up to 70 kg N ha-1was directly proportional to increase in total variable cost. The highest and lowest revenue, gross margin and return per naira invested were recorded with RSNPK and RSC, respectively. Based on this, RSNPK was suggested for small holder rubber farmers.

INTRODUCTION

Natural rubber (*Hevea brasiliensis*) production in Nigeria has suffered serious setback in recent time, resulting from the withdrawal of the smallholder rubber producer from production owing majorly to the income gap created by the long gestation period taking for rubber to get to maturity before the farmer can begin to recoup money invested and gains, low prices of rubber in the international market amid other agronomic challenges, most serious among these challenges is the fallow land resulting from rubber spacing which results in increase in cost of production (plantation maintenance e.g weeding) and the size of land needed for plantation establishment (Michael, 2006; NRAN, 2014, Esekhade, *et. al*., 2017). Despite the increase in price of natural rubber in the international market, there has not been a corresponding increase in rubber production.(NRAN, 2014; Uwumarongie *et. al*., 2022). Hence research in rubber production have mirrored the problem of the withdrawal of the small holder producers majorly to the income gap created in the period of waiting for rubber to get to maturity before tapping to generate income. To return these small holder rubber farmer to production, there is the need to incorporate other high economic value arable crop with rubber to serve as additional source of income during the immature phase of rubber thereby bridging the income gap and making sustainable income available through sales of the harvested arable crop before rubber gets to maturity as reported by Haliru, (2015) that intercropping rubber with arable crops is beneficial to the growth of rubber and the arable crop is capable of generating income that will cushion the effect of income gap experienced before rubber gets to maturity.

Snake tomato *(Trichosanthes cucumerina* L. Haines) crop is mainly cultivated for the red fruit pulp used as a substitute for the regular tomato sauce. The pulp is known to provide protection against harmful free radicals (Uwumarongie *et. al.,* 2013). The scarcity and untold price hike that occur annually as a result of the off season of the tomato plant and recent invasion by *Tuta absoluta* that ravaged the entire tomato farm directed research efforts to looking for an alternative to the regular tomato. Snake tomato is a neglected and under utilised crop and its cultivation and use as an alternative to the regular tomato is attracting global interest (Uwumarongie *et. al*., 2021) as its pulp is known to contain substances that provide protection against harmful free radicals. Research have further revealed that its consumption is strongly associated with reduced risk of chronic diseases such as cardiovascular diseases, cancer, diabetes, Alzheimer disease, cataracts and age related functional decline in addition to other health benefits (Sahlin *et al.,* 2004; Zhang and Hamauzu, 2004) . Intercropping rubber with this crop would generate revenue that will serve as an additional income and early returns to the rubber farmer during the waiting period of rubber as the crop can be grown twice in the cropping season. It also helps in control of weeds as the idle land in the plantation will be used up by the companion crop, ensure efficient resource use in the plantation, and reduce the cost of plantation maintenance and production.

Cost of inorganic fertilizer, its availability, adulteration and its attendant effects on the world economy has been a source of concern, hence the need for an alternative. The disposal of rubber processing effluent has been a major challenge to factory owners and a source of pollution, but its use as soil nutrient amendment will go a long way to ameliorating the challenge. Hence, this study was undertaken to evaluate the profitability of snake tomato fruit production in a three and four years old (existing) rubber plantation using NPK and rubber processing effluent as soil nutrient amendment.

MATERIALS AND METHODS

Experimental Site

This study was conducted in 2018 and 2019 cropping seasons at the Research Farm of Rubber Research Institute of Nigeria (RRIN) within the Rain Forest zone of Edo State, Nigeria. The study site occupied a land area of 2,070 ha. The study area falls between latitude $6^0$00and $7^0$00′N and longitude $5^0$00′ and $6^0$00′E. The annual rainfall ranged between 1800 – 2300 mm and relative humidity of 75 % (RRIN, 1998; Orimoloye, 2011). The area is characterized by a moderately high temperatures of 30^0C minimum and 32^0C maximum. The soils of this humid forest belt are mainly ultisols and the site is classified locally as kulfo series with pH ranging between 4.0 and 5.5.The soils have been described as the acid sands derived from unconsolidated grits and sand stones containing clay peds of varying proportions (Orimoloye, 2011).

Experimental Design and Field Layout

The treatments involved sole rubber and snake tomato and their intercropped combination (rubber-snake tomato intercrop) with NPK (applied at 60 kg N ha^{-1}) and rubber effluent application (0, 50, 60 and 70 kg N ha^{-1}) laid out in a randomized complete block design in three replicates. The treatments were:

RE1RS-Rubber effluent at the rate of 50 kg N ha^{-1}intercropped with rubber and snake tomato.

RE1ST- Rubber effluent at rate of 50 Kg N ha^{-1} cropped with sole snake tomato

RE2RS- Rubber Effluent at application rate of 60 Kg N ha^{-1}intercropped with rubber and snake tomato

RE2ST- Rubber Effluent at application rate of 60 Kg N ha^{-1}intercropped with sole snake tomato

RE3RS- Rubber Effluent at application rate of 70 Kg N ha^{-1}intercropped with rubber and snake tomato

RE3ST- Rubber Effluent at application rate of 60 Kg N ha^{-1}intercropped with sole snake tomato
RSC- Rubber and Snake Tomato intercrop without fertilizer treatment
STC- Sole Snake Tomato without fertilizer treatment
STNPK – Sole snake tomato treated with 60 kg N ha^{-1} of NPK 15:15:15
RSNPK – Rubber-snake tomato with 60 kg N ha^{-1} of NPK 15:15:15
For rubber component in the intercrop, the treatments were:
RE1RS-Rubber Effluent at application rate of 50 Kg N ha^{-1} cropped with rubber and snake tomato (Intercrop)
RE1SR- Rubber Effluent at application rate of 50 Kg N ha^{-1} cropped with sole rubber
RE2RS- Rubber Effluent at application rate of 60 Kg N ha^{-1} cropped with rubber and Snake tomato (Intercrop)
RE2SR- Rubber Effluent at application rate of 60 Kg N ha^{-1} cropped with sole rubber
RE3RS- Rubber Effluent at application rate of 70 Kg N ha^{-1} cropped with rubber and snake tomato (Intercrop)
RE3SR- Rubber Effluent at application rate of 60 Kg N ha^{-1} cropped with sole rubber
RSC- Rubber and snake tomato intercrop control
SRC- Sole Rubber Control without fertilizer treatment

Cultural practices

The plot measuring 26 x 60m was cleared of the existing vegetation manually with the aid of cutlasses and hoes, the debris was packed out of the plot and, thereafter, the field was marked out into plots measuring 3 x7 m with one meter pathway. The rubber effluent was applied two weeks before the transplanting of the budded rubber stump to the designated plots as per treatment. The Rubber saplings (budded rubber stump) were transplanted to the field two weeks after application of effluent. The pulled budded stump (young rubber) was placed in the hole in such a way that the budded patch is just above the ground level at a spacing of 3 x7m which gave rise to 476 stands per hectare, each plot had four rubber stand.

Two-week old snake tomato seedlings were transplanted to the field one week after rubber saplings were transplanted at a spacing of 0.5 x 0.5m which gave rise to a total of 40,000 plants ha^{-1}. The NPK fertilizer was applied to the designated plots as per treatment at two weeks after transplanting of snake tomato seedlings. The plots were irrigated immediately after planting. Missing stands were supplied eight days after transplanting. Weeds were controlled manually as and when due. The plants were sprayed with a mixture of neem leaf extract and garlic against lepidopterous larvae and fungus diseases (Law-Ogbomo *et al*., 2018)

Data Collection

Estimate of fruit yield was obtained from the fruit weight. Fruit weight per plant was obtained through the summation of all the harvested fruits from the sampled plants divided by the number of plant to obtain the average calibrated in kg. From fruit weight, fruit yield was estimated thus:

Fruit yield = $\frac{Fruit\ weight}{Ground\ area} \times 10\ t\ ha^{-1}$

Gross margin and viability ratio were used to determine the profitability of the effect of soil amendment on snake tomato fruit production in rubber-snake tomato intercrop. The estimator for gross margin was expressed as:

GM = $\sum_{i=1}^{n} P_{yi}\ .Y_i - \sum_{j=1}^{m} P_{xj}\ .X_j$ …………………………….. (1)

Where GM - gross margin
Y_i - Enterprise's product (s) where (I = 1, 2, 3…………….n products)

P_{yi} – Unit price of the product
Xj – Quantity of the variable input (where j = 1, 2, 3 ….n variable inputs)

i.e. GM = Total revenue (TR) – Total variable cost (TVC)………..(2)

Returns per naira invested = $\frac{TR}{TVC}$

The total variable cost includes cost of labour on land preparation, sowing, transplanting, fertilizer application/manuring, vine caring, harvesting and processing; cost of planting materials, cost of NPK/rubber effluent, transportation, stakes and twine.

The data collected were subjected to analysis of variance using GENSTAT statistical package twelfth edition 2012 version. Means were separated using least significant difference (LSD) at 5% level of probability.

Data Analysis

Data collected were subjected to analysis of variance using GENSTAT statistical package twelfth edition. Means were separated using least significant difference (LSD) at 0.05 level of probability

RESULTS AND DISCUSSION

Soil property and rubber affluent composition

The soils of the plantation prior to cropping with snake tomato were strongly acidic and low in organic C, total N, available P and exchangeable Ca (Table 1). This implied that the soil has low fertility status. This finding is in agreement with Law-Ogbomo and Osaigbovo (2018) who reported that most Nigerian soils are of low native fertility owing to the highly weathered soils coupled with leaching and continuous cropping. Low

soil fertility status without adequate soil nutrient amendment will result in growth and yield depression due to nutrient deficiencies (Law-Ogbomo *et al*., 2020).

The chemical analysis of the rubber effluent used for the study showed that it is moderately acidic with total dissolved solids, chemical oxygen demand and biochemical oxygen demand (Table 2). It contained N, available P, organic C, K, Mg, Na and Ca in appreciable amount. This observation is in agreement with Orhue *et al*. (2007) who reported highly significant amount of total suspended and dissolved solids, phosphate and total N in rubber effluent. This is an indication that rubber effluent, which ought to be a waste and pollutant to the environment can be made to be an avenue for wealth creation through its conversion to organic fertilizer.

RESULTS

Soil property and rubber affluent composition

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FRUIT YIELD

The result of the fruit yield of snake tomato in an existing three and four years old plantation is presented in table 3. In both the three and four year old plantation experiments and in the combined analysis, RSNPK plants had the highest fruit yield (44.03, 66.07 and 55.05 respectively) which was not significantly different from plants in STNPK (39.07, 64.73 and 51.90). Unfertilized plants (STC and RSC) had the lowest fruit yield. However, in the 3^{rd} year experiment, unfertilized plants were similar with RE1RS and RE1ST plants. In the 4^{th} year experiment, plants in STC and RSC were similar with the plants in RE1RS and RE2ST while in the combined analysis, RSC and STC plants were similar with plants in RE1RS. Fruit yield was higher majorly in the fertilized plots, in the 4^{th} year experiment than in the 3^{rd} year experiment but the control experiment the third year was higher than the fourth year which is attributed to residual effect of the fertilizer from the third year and mulching effect of the leftover from the harvested in the third year while for the unfertilized plots was attributed to the reduction in the native nutrient inherent in the soil as a result of third year cropping. Fruit yield increased with increasing rate of rubber effluent application and peak at the highest rate of application. The fruit of the highest effluent application rate (RE3RS and RE3ST) was inferior to NPK treated plants (RSNPK and STNPK).

Table 1: Pre-cropping characterization of some selected soils properties from the experimental site

Parameter	Site: New plantation	Site: Existing plantation	Critical level	Fertility class
pH(H_2O) 1:1	5.40	5.40		SA
Organic carbon (g kg^{-1})	17.20	17.20		Low
Total nitrogen (g kg^{-1})	0.84	0.81	1.50 g kg^{-1} (Solulo and Osiname, 1981)	Low
C:N	20.48	21.23		
Available phosphorus (mg kg^{-1})	10.50	13.00	16.00 mg kg^{-1} (Adepetu*et al*., 1979)	Low
Exchangeable cation (cmol kg^{-1})				
Calcium	0.80	0.82	2.60 cmol kg^{-1} (Agboola and Corey, 1973)	Low
Magnesium	0.20	0.25		
Ca/Mg	4.00	3.40	3.00 (FDALAR, 1975)	Adequate
Potassium	0.16	0.17	0.16 - 0.20 (Hunter, 1975)	
Sodium	0.06	0.06		
Exchangeable acidity (cmol kg^{-1})				
Hydrogen	0.20	0.16		
Aluminium	0.10	0.11		
Particle size (gk g^{-1})				
Sand	886.00	886.00		NA
Silt	61.00	64.00		NA
Clay	39.00	36.00		NA
Textural class	Sandy loam	Sandy loam		NA

SA - Strongly acidic NA - Not applicable

Table 2: Chemical composition of rubber effluent

Parameter	Value
pH (H_2O)	6.20
Organic carbon (%)	29.60
Total nitrogen (%)	1.10
Phosphorus (%)	2.03
Potassium (%)	0.22
Magnesium (%)	0.38
Calcium (%)	0.49
Sodium (%)	0.04
Zinc (%)	0.05
Copper (%)	0.02
Manganese (%)	0.08
Iron (%)	0.10
Chemical oxygen demand (mg l^{-1})	410.00
Biochemical oxygen demand (mg l^{-1})	250.00
Total dissolved solids (mg l^{-1})	760.00

Table 3: Effect of soil amendment on fruit yield of snake tomato cropped in a three and four years old existing rubber plantation

Treatment	Fruit yield (t ha^{-1})		
	3rd	4th year	Combined
RE1RS	27.30	24.10	25.70
RE1ST	28.07	28.83	28.45
RE2RS	29.57	36.70	33.13
RE2S2	32.40	36.33	34.37
RE3RS	29.97	42.27	36.12
RE3ST	33.27	45.47	39.37
RSC	22.63	21.00	21.87
RSNPK	44.03	66.07	55.05
STC	23.10	20.20	21.65
STNPK	39.07	64.73	51.90
Mean	30.94	38.58	34.76
$LSD_{(0.05)}$	8.036	9.051	6.100
$LSD_{(0.05)}$ year	2.728		

Foot note
RE1RS - Rubber effluent at application rate of 50 kg N ha^{-1} cropped with rubber and snake tomato (Intercrop)
RE1ST - Rubber effluent at application rate of 50 kg N ha^{-1} snake tomato (Sole)
RE2RS - Rubber effluent at application rate of 60 kg N ha^{-1} cropped with rubber and snake tomato (Intercrop)
RE2ST - Rubber effluent at application rate of 60 kg N ha^{-1} snake tomato (Sole)
RE3RS - Rubber effluent at application rate of 70 kg N ha^{-1} cropped with rubber and snake tomato (Intercrop)
RE3ST - Rubber effluent at application rate of 70 kg N ha^{-1} snake tomato (Sole)
RSC - Rubber-snake tomato intercrop without NPK/rubber effluent treatment (control)
STC - Sole snake tomato (control)
STNPK - Sole snake tomato treated with 60 kg N ha^{-1} of NPK 15:15:15
RSNPK - Rubber-snake tomato treated with 60 kg N ha^{-1} of NPK 15:15:15

Economic return

Economic of snake tomato cropping in a three and four years old plantation on fruit production is presented in Table 4 and 5. The total variable cost varied from ₦ 200,917.75 to ₦ 296,667.75 for RSC and RSNPK, respectively for the three year old plantation while the four years old plantation varied from ₦ 197,880.00 to ₦ 324,217.50 for STC and RSNPK. Generally, increase in rubber effluent application rate up to 70 kg N ha^{-1}was directly proportional to increase in total variable cost The highest and lowest revenue, gross margin and return per naira invested were recorded with RSNPK and RSC, respectively. Increase in revenue, gross margin and return per naira invested was also directly proportional to increase in rubber effluent application rate. Revenue, gross margin and returns per naira invested varied among the treatments applied in both the third and the fourth year plantation. RSC had negative gross margin and less than one in return per naira invested in the third year experiment while in the fourth year experiment RE1RS and STC had negative gross margin and less than one in return per naira invested. This implies that fertilization is important for achieving profitability as the unfertilized snake tomato plant yielded negative gross margin and less than 1.00 returns per naira invested. The economic viability of the fertilized plants could be due to higher fruit yield. The unfertilized snake tomato plants both sole and intercropped were not viable due to poor yield. The success of this system is an indication that rubber farmers can begin to generate revenue successfully and cushion the income gap created by the long gestation period taking for rubber to get to maturity before tapping in the first four years of establishment. This will result in the return of the small holder rubber farmers to production, which will result in economic development and eventually lead to improvement of their standard of living for sustainable rural development and poverty alleviation. Furthermore, the revenue accrued from snake tomato cropping in the three and four years old rubber plantation is an indication that under-utilized land resources in the spaces between rubber plants at the early stage of its growth and development can be efficiently utilized by snake tomato to ensure income flow to the farmers. This observation was in agreement with findings by Giroh *et al.,* (2011) who reported that, intercropping rubber with other crops was profitable and provided an additional source of revenue to farmers.

CONCLUSION AND RECOMMENDATION

The study shows that intercropping rubber plant with snake tomato and amending the soil with NPK and rubber effluent was economically viable. The fruit yields of both sole and intercropped snake tomato did not differ significantly. Utilizing the idle land, resulting from rubber plant spacing to growing snake tomato enhanced income flow to farmers in the first four years of the investment. Soils of the experimental site had low nutrient status. Fertilizer application increased the fruit yield of snake tomato and the profitability of the enterprise as the unfertilized plants were not economically viable. Based on the findings from this study, snake tomato intercropping with rubber should be supplemented with fertilizer application to improve the fertility of the soil for higher growth of rubber and fruit yield of snake tomato. The optimum returns were observed on fruit yield obtained from STNPK and RSNPK (sole and intercropped snake tomato treated with NPK applied at 60 Kg N ha^{-1} (400 Kg NPK ha^{-1}). Rubber-snake tomato intercrop treated with NPK applied at 60 kg N ha^{-1} (400 kg NPK ha^{-1}) is thereby recommended for small holder rubber farmers and in cases where the source of rubber effluent is close to the plantation, the use of rubber effluent applied at 70 kg N ha^{-1} is also recommended as this will cut down on cost of transportation and reduced variable cost which can result higher gross margin and return per naira invested.

Table 4: Economic of snake tomato cropped in a three year rubber plantation treated with rubber effluent and NPK

Item cost and return (N ha^{-1})	RE1RS	RE1ST	RE2RS	RE2ST	RE3RS	RE3ST	RSC	RSNPK	STC	STNPK	$LSD_{(0.05)}$
Land preparation	60,000.00	60,000.00	60,000.00	60,000.00	60,000.00	60,000.00	60,000.00	60,000.00	60,000.00	60,000.00	ns
Planting material	13,000.00	13,000.00	13,000.00	13,000.00	13,000.00	13,000.00	13,000.00	13,000.00	13,000.00	13,000.00	ns
Sowing	5,000.00	5,000.00	5,000.00	5,000.00	5,000.00	5,000.00	5,000.00	5,000.00	5,000.00	5,000.00	ns
Pre-emergent herbicide and its application	34,630.00	34,630.00	34,630.00	34,630.00	34,630.00	34,630.00	34,630.00	34,630.00	34,630.00	34,630.00	ns
Fertilizer and its application	9,000.00	9,000.00	11,000.00	11,000.00	13,000.00	13,000.00	0.00	69,000.00	0.00	69,000.00	1147.100
Stake collection and staking	30,000.00	30,000.00	30,000.00	30,000.00	30,000.00	30,000.00	30,000.00	30,000.00	30,000.00	30,000.00	ns
Harvesting, processing and packaging	54125.00	65087.50	66962.50	70000.00	67462.50	71587.75	58287.75	85037.75	58875.00	78837.50	543.700
Total variable cost	205755.0	216717.50	220592.50	223630.00	223092.50	227217.75	200917.75	296667.75	201505.00	290467.50	31800.800
Revenue	235875.00	245612.50	258737.50	283500.00	262237.50	291112.50	198012.50	385262.50	202125.00	341862.50	32282.600
Gross margin	30120.00	28895.00	381445.00	59870.00	39145.00	63894.75	-2905.25	88594.75	620.00	51395.00	8172.700
Return per naira invested	1.15	1.13	1.18	1.27	1.18	1.28	0.99	1.30	1.00	1.18	0.069

RE1RS - Rubber effluent at application rate of 50 kg N ha-1 cropped with rubber and snake tomato (Intercrop)
RE1ST - Rubber effluent at application rate of 50 kg N ha-1 snake tomato (Sole)
RE2RS - Rubber effluent at application rate of 60 kg N ha-1 cropped with rubber and snake tomato (Intercrop)
RE2ST - Rubber effluent at application rate of 60 kg N ha-1 snake tomato (Sole)
RE3RS - Rubber effluent at application rate of 70 kg N ha-1 cropped with rubber and snake tomato (Intercrop)
RE3ST - Rubber effluent at application rate of 70 kg N ha-1 snake tomato (Sole)
RSC - Rubber-snake tomato intercrop without NPK/rubber effluent treatment (control)
STC - Sole snake tomato (control)
STNPK - Sole snake tomato treated with 60 kg N ha-1 of NPK 15:15:15
RSNPK - Rubber-snake tomato treated with 60 kg N ha-1 of NPK 15:15:15

Table 5: Economic of snake tomato cropped in a four year rubber plantation treated with rubber effluent and NPK

Item cost and return (N ha^{-1})	RE1RS	RE1ST	RE2RS	RE2ST	RE3RS	RE3ST	RSC	RSNPK	STC	STNPK	$LSD_{(0.05)}$
Land preparation	60,000.00	60,000.00	60,000.00	60,000.00	60,000.00	60,000.00	60,000.00	60,000.00	60,000.00	60,000.00	ns
Planting material	13,000.00	13,000.00	13,000.00	13,000.00	13,000.00	13,000.00	13,000.00	13,000.00	13,000.00	13,000.00	ns
Sowing	5,000.00	5,000.00	5,000.00	5,000.00	5,000.00	5,000.00	5,000.00	5,000.00	5,000.00	5,000.00	ns
Pre-emergent herbicide and its application	34,630.00	34,630.00	34,630.00	34,630.00	34,630.00	34,630.00	34,630.00	34,630.00	34,630.00	34,630.00	ns
Fertilizer and its application	9,000.00	9,000.00	11,000.00	11,000.00	13,000.00	13,000.00	0.00	69,000.00	0.00	69,000.00	1402.900
Stake collection and staking	30,000.00	30,000.00	30,000.00	30,000.00	30,000.00	30,000.00	30,000.00	30,000.00	30,000.00	30,000.00	ns
Harvesting, processing and packaging	60,125.00	66,037.50	75,875.00	75,412.50	82,837.50	86,837.50	56,375.00	112,587.50	55,250.00	110,912.50	12.480
Total variable cost	211,755.00	218,667.50	229,505.00	229,042.50	238,467.50	242,467.50	199,005.00	324,217.50	197,880.00	322,542.50	625.700
Revenue	210,875.00	252,262.50	321,125.00	317,887.00	369,862.50	387,862.50	184,625.00	578,112.50	176,750.00	566,387.50	5.267
Gross margin	-880.00	33,595.00	91,620.00	88,844.50	131,395.00	145,395.00	14,380.00	253,895.00	-21,130.00	243,845.00	13.030
Return per naira invested	0.99	1.15	1.40	1.39	1.55	1.60	0.93	1.78	0.89	1.76	0.034

RE1RS - Rubber effluent at application rate of 50 kg N ha-1 cropped with rubber and snake tomato (Intercrop)
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RE3ST - Rubber effluent at application rate of 70 kg N ha-1 snake tomato (Sole)
RSC - Rubber-snake tomato intercrop without NPK/rubber effluent treatment (control)
STC - Sole snake tomato (control)
STNPK - Sole snake tomato treated with 60 kg N ha-1 of NPK 15:15:15
RSNPK - Rubber-snake tomato treated with 60 kg N ha-1 of NPK 15:15:15

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