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Performance of sweet potato germplasm under coconut based cropping system

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ABSTRACT

An experiment was conducted in coconut plantation of AICRP on palms, HRS, Mondouri, BCKV, during rabi season of 2018-2020 for evaluation of sweet potato under coconut. Seven sweet potato germplasms viz. S1010, BCSP-14, BCSP-10, TSP-12-14, 90/101, ST-14 and Kishan were laid out in RBD with three replications. Five plants tagged randomly for recording the data like length of vine (cm),number of leaves plant^{-1}, number of new twigs plant^{-1}, number of branches plant^{-1}, fresh and dry weight of plant (g), fresh and dry weight of tubers (g plant^{-1}) , number of tubers plant^{-1}, yield kg plot^{-1}, projected yield t ha^{-1} and cost benefit ratio. At 150 DAP maximum vine length of 357.04 cm was recorded in BCSP-10 and maximum number of branches was found in BCSP-14 (12.58). S1010 recorded maximum tuber weight of 199.02g. Kishan recorded mean maximum tuber dry weight of 18.64g per 50g sample. The tuber yield (9.48 kg plot^{-1}), projected tuber yield (6.49 t ha^{-1}) and maximum B: C ratio of 1.70 with a net economic return of Rs.195647 ha^{-1} was recorded in S1010.

Keywords: BC ratio, coconut equivalent yield, intercropping, sweet potato and yield

Coconut (*Cocos nucifera* Linn.) an important plantation crop of India belongs to family Palmae. It plays an important role in contributing to India's GDP of about 15,000 crore. About 72% of world's total production is from India with high productivity. In India, coconut is grown in an area of 21.79 million ha with an estimated production of 21,384.36 million nuts year^{-1} and average productivity of 9,815 nuts ha^{-1} as recorded during 2018-19 (Anon., 2020). Due to fragmentation of holdings, frequent fluctuation of input cost, fall in price of coconut, severity of many pests and diseases coconut farmers of the country are in a very precarious situation. Therefore, there is an urgent need to make coconut cultivation profitable by increasing the yield through different management practices. Coconut garden itself offer excellent opportunities to exploit the inter space potential for maximizing returns per unit area. Cultivation of compatible crops in the interspaces of the coconut plantation under coconut based cropping system offers considerable scope for increasing production and productivity per unit area, time and inputs by more efficient utilization of resources like sunlight, soil, water and labor. Coconut is normally planted in a distance of 7.5m x7.5m with a plant population of 177 palms ha^{-1} to give a wider space to the crown shape and length of coconut leaves. But the different experimental evidences showed that coconut as sole crop with this spacing does not fully utilize the available basic resources of crop production like soil, solar energy, water and nutrients. Coconut being a monocot plant has its typical adventitious root system where on an average 4000 to 7000 roots are found in the middle aged palm out of which about 74% of the roots produced by the palm did not go beyond 2m lateral distance and 82% of the roots were confined in between 31 to 120 cm depth (Kushwah *et al.,* 1973). Kumar and Wahid (1988) reported that more than 80% of the root activity of coconut palm was confined to a lateral distance of 2m from the trunk. Nair (1979) reported that coconut leaf orientation and Venetian structure of coconut crown allow part of the incident solar radiation to pass through the canopy to fall on the ground. It has been reported that the light intensity at ground level always higher than 6700 lux throughout the year. In a coconut palm the leaves are not randomly distributed, but clumped around a few widely spaced growing points. Soil fertility, varietal characteristics of coconut, age of the palms, spacing, leaf area and time of the day influence the light penetration through canopy. Nair and Balakrishnan (1976) reported that in palms aged around 25 years maximum 56% of the sunlight was transmitted through the canopy to the soil during peak hours (10-16 hrs.) of a day. A high use efficiency of the available soil moisture and available nutrients can be achieved by growing intercrops outside 2m radius around the base of the palms. Cropping system aims at crop diversification and intensive cropping in the inter space of coconut plantation which increase the productivity

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per palm in a system approach where available resources like soil and water, farm labor, agriculture inputs like seeds, fertilizers, agro chemicals etc. are efficiently utilized to produce both nuts, food and nonfood items from the farm in a sustainable way. Under such a cropping system model all the management practices and also component production systems should be able to maintain high productivity, profitability and sustainability of the existing coconut palms to maximize higher economic return of the farm. In a farming system model the main objectivity is sustainability where production process is optimized through efficient utilization of the inputs in safeguarding the environment. As a result to make coconut cultivation profitable by utilizing the diffused sunlight facilitates remaining area under coconut plantation could profitably be exploited for growing of a number of shade tolerant crops like sweet potato in the interspaces as subsidiary crops. Considering the above, an experiment was conducted under 38 years old coconut plantation in the All India Coordinated Research Project on Palms at HRS, Mondouri, BCKV with different germplasms of sweet potato during *rabi* season of 2018-2020 as tuber crops are the most important food crop after cereals and contribute 6% of the average daily calorie intake of human kind and sweet potato itself contains 24 mg of vitamin C per 100 g of fresh tuber.

MATERIALS AND METHODS

The experiment was conducted in a 38 years old coconut plantation of AICRP on palms, at Horticulture Research Station, Mondouri during *rabi* season of 2018-19 and 2019-2020 and in the laboratory of Department of Plantation, Spices, Medicinal and Aromatic Crops, BCKV for studying the performance of different sweet potato germplasms under coconut based cropping system in West Bengal. The coconut palms were planted at a spacing of 7.5m x7.5m. The research station is located at latitude of $23^0$50' North, Longitude of 80^0 02' East and at altitude of 9.75 meters above mean sea level. The experimental plots in between coconut palms were ploughed thoroughly with a power tiller in the second fortnight of October, during 2018 and 2019. The land was thoroughly prepared by plouging followed by laddering. The subsequent operations were done with harrow, spade etc. to remove the weeds and stubbles from the field. The surface was leveled with a spade and irrigation channels were made around the plots. The corners of the plots were prepared by the spade. The layouts of the experiment were prepared according to the design of experiment. FYM @ 5t ha^{-1} along with recommended doses of fertilizer for sweet potato (N: P: K- 75:60:75 Kg ha^{-1}) were applied in two splits doses. Half dose of N, full dose of P_2O_5 and half dose of K_2O were applied as basal during land preparation and rest of the quantity were applied at 45 days after planting as top dressing followed by earthing up. Healthy and disease free terminal cutting of sweet potato (15-20 cm) was taken as planting materials. Seven sweet potato germplasms *viz*. S1010, BCSP-14, BCSP-10, TSP-12-14, 90/101, ST-14 and Kishan were laid out in Randomized Block Design with three replications. 32 number of sweet potato plants were planted at a spacing of 30 cm x 60 cm in 2.4m x 2.4m plot during first fortnight of November each year. Watering is done immediately after planting of cutting. Afterward each plot was irrigated at 10 days interval to keep the field soil nearly at field capacity. Excess water was drained out properly as and when required. The experimental plots were kept weed free by hand weeding twice at 30 days and 60 days after planting. Insecticide "Tricel" was applied @ 3 ml $liter^{-1}$of water as per requirement. Five plants from each plot were selected randomly for recording of the data like length of vine (cm), number of leaves $plant^{-1}$, number of new twigs $plant^{-1}$, number of branches $plant^{-1}$, fresh weight of plant (g), dry weight of plant (g), fresh weight of tubers (g $plant^{-1}$), dry weight of tubers (g $plant^{-1}$), number of tubers $plant^{-1}$, yield $plot^{-1}$ (kg), projected yield (t ha^{-1}), projected biomass yield (kg ha^{-1}) and cost :benefit ratio. Statistical analysis for each variable was conducted as per the procedure given by Gomez and Gomez (1984) and significance of different sources of variations were tested by Fisher and Snedecor's 'F' test at 0.05 probability level. Least significant differences among the levels of the factors along with this interaction effects were worked out using appropriate formula (Gomez and Gomez, 1984) and taking help from the statistical table by Fisher and Yates (1974).

RESULTS AND DISCUSSION

Growth parameters

Vine length and number of branches

Two years data presented in Table-1 on vine length and number of branches of 7 germplasms of sweet potato at 30, 90 and 150 days after planting indicated that germplasm ST-14 recorded maximum mean vine length of 37.29 cm at 30 DAP and S1010 recorded minimum of 20.78cm during this period. Similarly at 90 DAP, maximum vine length of 192.30 cm was recorded in the germplasm TSP12-14 followed by BCSP-14 (189.69cm) and BCSP-10 (188.38cm) which were at par with each other. However, Kishan recorded minimum vine length of 80.56 cm. At 150 DAP, maximum vine length of 357.04cm was noted in the germplasm BCSP-10 and S1010 registered minimum of 178.29cm. Mean data analysis also revealed that

Table1: Vine length and number of branches of sweet potato grown under coconut based cropping system

Germplasm	Vine length (cm)									Number of branches plant $^{-1}$								
	30DAP			90DAP			150DAP			30DAP			90DAP			150DAP		
	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean
S1010	20.70	20.87	20.78	114.98	111.43	113.21	174.14	182.44	178.29	1.88	2.00	1.94	4.08	4.40	4.24	10.46	10.60	10.53
BCSP-14	22.97	19.87	21.42	190.06	189.32	189.69	289.23	308.54	298.89	2.06	2.25	2.15	3.83	2.40	3.12	12.54	12.61	12.58
BCSP-10	21.27	27.47	24.37	189.75	187.02	188.38	350.82	363.26	357.04	2.22	1.50	1.86	3.44	5.25	4.35	10.11	9.40	9.75
TSP12-14	30.38	33.37	31.88	192.92	191.67	192.30	282.96	289.70	286.33	1.80	2.40	2.10	3.18	3.40	3.29	8.42	8.20	8.31
90/101	26.47	33.00	29.74	119.59	132.04	125.81	250.66	269.44	260.05	1.79	2.40	2.09	3.65	2.60	3.13	11.65	11.21	11.43
ST-14	34.91	39.67	37.29	151.70	157.49	154.60	318.76	330.65	324.70	2.02	2.60	2.31	3.93	3.00	3.47	11.80	11.60	11.70
Kishan	22.17	24.68	23.42	81.82	79.30	80.56	235.16	243.50	239.33	2.57	2.00	2.28	2.94	3.00	2.97	5.24	11.41	8.33
SEm (±)	**2.24**	**1.67**	**1.72**	**3.22**	**4.28**	**2.95**	**3.05**	**6.00**	**2.53**	**0.26**	**0.04**	**0.28**	**0.12**	**0.03**	**0.55**	**0.32**	**0.48**	**1.22**
LSD (0.05)	**6.99**	**5.20**	**6.07**	**10.03**	**13.34**	**10.41**	**9.49**	**18.70**	**8.92**	**NS**	**0.11**	**NS**	**0.38**	**0.09**	**NS**	**1.01**	**1.51**	**NS**

Table 2: Number of leaves and new twigs of sweet potato grown under coconut based cropping system

Germplasm	Number of leaves plant^{-1}									Number of new twigs plant^{-1}								
	30DAP			90DAP			150DAP			30DAP			90DAP			120DAP		
	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean
S1010	16.91	16.81	16.86	27.38	26.63	27.00	107.72	106.34	107.03	2.08	2.00	2.04	3.94	4.00	3.97	2.48	2.00	2.24
BCSP-14	16.65	17.00	16.83	26.36	25.06	25.71	152.40	152.77	152.58	1.85	1.00	1.43	4.06	4.20	4.13	2.39	1.00	1.70
BCSP-10	16.07	18.82	17.45	31.01	28.45	29.73	103.64	100.78	102.21	1.64	1.66	1.65	3.21	3.50	3.36	1.50	1.00	1.25
TSP-12-14	14.09	14.60	14.35	25.79	26.59	26.19	86.11	83.41	84.76	2.00	1.66	1.83	3.82	4.20	4.01	1.35	1.00	1.18
90/101	15.72	16.60	16.16	24.93	24.51	24.72	127.66	126.62	127.14	1.58	2.00	1.79	4.05	4.20	4.13	1.67	0.00	0.83
ST-14	15.37	16.41	15.89	25.86	26.27	26.06	142.10	140.02	141.06	1.58	1.80	1.69	3.80	4.80	4.30	1.42	1.00	1.21
Kishan	18.83	21.81	20.32	28.82	27.48	28.15	152.45	151.06	151.76	1.83	1.50	1.67	4.05	4.40	4.23	1.38	0.00	0.69
SEm (±)	**0.51**	**1.23**	**0.60**	**0.92**	**1.29**	**0.57**	**1.31**	**2.25**	**0.55**	**0.15**	**0.0**	**0.21**	**0.13**	**0.21**	**0.16**	**0.08**	**0.02**	**0.28**
LSD (0.05)	**1.60**	**3.83**	**2.11**	**2.88**	**NS**	**2.01**	**4.08**	**7.02**	**1.95**	**NS**	**0.08**	**NS**	**0.41**	**0.66**	**NS**	**0.24**	**0.05**	**NS**

Table 3: Number, length, diameter and weight of sweet potato tubers grown under coconut based cropping system

Germplasm	Number of tubers plant^{-1}			Tuber length (cm)			Tuber diameter (cm)			Fresh weight of tuber(g)		
	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean
S1010	5.72	5.40	5.56	12.36	13.86	13.11	4.21	4.54	4.37	197.80	200.25	199.02
BCSP-14	3.79	3.60	3.70	15.22	16.09	15.66	2.22	3.07	2.64	126.15	137.74	131.95
BCSP-10	4.18	3.40	3.79	13.85	11.34	12.60	3.04	2.41	2.73	97.52	95.11	96.31
TSP-12-14	3.65	3.20	3.43	17.52	17.60	17.56	3.58	2.87	3.23	115.41	117.88	116.65
90/101	5.24	2.60	3.92	13.82	13.12	13.47	4.92	4.83	4.88	177.48	183.73	180.61
ST-14	5.21	5.00	5.11	12.93	12.26	12.60	2.75	2.96	2.86	179.19	181.64	180.41
Kishan	5.71	4.60	5.16	14.52	14.45	14.48	2.19	2.34	2.27	103.24	106.16	104.70
S Em (±)	**0.40**	**0.43**	**0.44**	**0.53**	**0.32**	**0.64**	**0.48**	**0.42**	**0.27**	**2.96**	**2.45**	**2.15**
LSD (0.05)	**1.25**	**1.35**	**NS**	**1.65**	**0.99**	**2.27**	**1.50**	**1.32**	**0.97**	**9.22**	**7.63**	**7.60**

Table 4: Fresh weight, dry weight, yield per plot and projected yield per ha of sweet potato tubers grown under coconut based cropping system

Germplasm	Fresh weight of tuber (g plant^{-1})			Dry weight of tuber (g 50g^{-1})			Yield (kg plot^{-1})			Projected yield (t ha^{-1})		
	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean
S1010	378.17	292.5	335.35	10.86	10.99	10.93	8.56	10.40	9.48	13.70	16.64	15.17
BCSP-14	240.83	372.4	306.60	17.45	18.07	17.76	5.72	4.91	5.32	9.15	7.86	8.51
BCSP-10	94.00	107.3	100.67	10.15	10.75	10.45	2.17	3.53	2.85	3.47	5.65	4.56
TSP-12-14	201.83	272.7	237.27	11.38	11.83	11.61	5.39	4.68	5.04	8.63	7.49	8.06
90/101	339.17	289.3	314.21	8.68	8.92	8.80	6.19	8.57	7.38	9.91	13.71	11.81
ST-14	405.17	377.1	391.14	7.92	8.15	8.03	8.40	7.80	8.10	13.45	12.48	12.96
Kishan	196.83	174.0	185.44	18.42	18.86	18.64	5.92	5.61	5.76	9.47	8.98	9.22
S Em (±)	**36.67**	**15.30**	**37.37**	**0.89**	**0.25**	**0.09**	**0.27**	**0.08**	**0.68**	**0.43**	**0.14**	**1.09**
LSD (0.05)	**114.23**	**47.70**	**131.84**	**2.77**	**0.78**	**0.34**	**0.84**	**0.26**	**2.40**	**1.35**	**0.42**	**3.82**

Table 5: Projected biomass yield of sweet potato grown under coconut based cropping system

Germplasm	Fresh weight of stem (g)			Dry weight of stem (g 100g^{-1})			Biomass yield (kg plot^{-1})			Projected biomass yield (t ha^{-1})		
	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean
S1010	480.08	407.00	443.54	7.04	7.57	7.31	15.02	14.56	14.79	24.04	23.30	23.67
BCSP-14	423.08	674.18	548.63	5.97	6.36	6.16	17.62	17.70	17.66	28.19	28.32	28.26
BCSP-10	422.40	442.26	432.33	6.94	7.00	6.97	19.09	21.36	20.23	30.55	33.11	31.83
TSP-12-14	242.08	224.09	233.09	6.70	6.95	6.82	15.19	20.81	18.00	24.30	25.29	24.80
90/101	353.88	262.34	308.11	7.63	7.92	7.77	14.19	16.23	15.21	22.71	25.97	24.34
ST-14	207.40	360.40	283.90	8.17	8.50	8.34	9.78	10.82	10.30	15.65	17.03	16.34
Kishan	385.71	601.09	493.40	6.13	6.55	6.34	17.06	22.93	20.00	27.30	29.75	28.53
SEm (±)	**23.24**	**7.38**	**69.97**	**0.40**	**0.32**	**0.07**	**0.36**	**0.62**	**1.26**	**0.57**	**0.90**	**0.72**
LSD (0.05)	**72.40**	**22.98**	**NS**	**1.25**	**1.00**	**0.26**	**1.11**	**1.93**	**4.44**	**1.78**	**2.82**	**2.52**

Table 6: Economics of sweet potato production under coconut based cropping system

Germplasm	Sweet Potato							Coconut		Economics			
	Projected yield (t ha^{-1})			Gross return (Rs. ha^{-1})				Yield (No. ha^{-1})	Gross return (Rs. ha^{-1}) production (C+SP)	Cost of production (C+SP)	Total gross return (C+SP)	Net profit (C+SP)	B:C ratio
	2019	2020	Mean	2019	2020	Mean	CEY	Mean	Mean	Mean	Mean	Mean	Mean
S1010	5.86	7.11	6.49	87838.00	106681.00	97260.00	6947.00	15225.00	213150.00	114763.00	310410.00	195647.00	1.70
BCSP-14	3.91	3.36	3.64	58677.00	50380.00	54529.00	3895.00	15137.00	211925.00	114763.00	266454.00	114762.00	1.00
BCSP-10	1.48	2.41	1.95	22246.00	36216.00	29231.00	2088.00	14875.00	208250.00	114763.00	237481.00	122718.00	1.07
TSP-12-14	3.69	3.2	3.45	55326.00	48013.00	51669.00	3691.00	15050.00	210700.00	114763.00	262369.00	147606.00	1.29
90/101	4.23	5.86	5.04	63518.00	87898.00	75708.00	5408.00	15137.00	211925.00	114763.00	287633.00	172870.00	1.51
ST-14	5.75	5.33	5.54	86196.00	80001.00	83098.00	5936.00	15400.00	215600.00	114763.00	298698.00	183935.00	1.60
Kishan	4.05	3.84	3.95	60684.00	57554.00	59119.00	4223.00	15155.00	212170.00	114763.00	271289.00	156526.00	1.36

N.B. : CEY = Coconut Equivalent Yield

number of branches of sweet potato developed within the period of 30 to 150 days was restricted in between 1.86 to 12.58 numbers per plant. It is clear that at 30 DAP out of 7 germplasms maximum 2.31 number of branches were recorded in the germplasm ST-14 followed by Kishan (2.28 numbers) and germplasm BCSP-10 recorded minimum of 1.86 numbers. At 90 DAP, maximum 4.35 number of branches were noted in the germplasm BCSP-10 followed by S1010 (4.24 numbers) while, Kishan recorded minimum of 2.97 numbers. At 150 DAP, number of branches were found maximum in BCSP-14 (12.58) whereas, it was recorded minimum (8.31) in the germplasm TSP-12-14.

Number of leaves and new twigs

Two years data presented in Table-2 on number of leaves of sweet potato indicated an increasing trend from 30 days to 150 days after planting. Mean data of two years clearly reflected that, at 30 DAP germplasm Kishan recorded maximum 20.32 numbers of leaves plant^{-1} whereas, it was recorded minimum (14.35) in the germplasm TSP12-14. At 90 DAP, maximum number of leaves (29.73) were recorded in the cultivar BCSP-10 closely followed by Kishan (28.15) and minimum in 90/101 (24.72). At 150 DAP, maximum number of leaves plant^{-1} was found (152.58) in BCSP-14 closely followed by Kishan (151.76) whereas, it was minimum (84.60) in the germplasm TSP-12-14. Number of new twigs plant^{-1} of sweet potato indicated an increasing trend from 30 DAP to 90 DAP after that, it was in decreasing trend. From the mean data it was clear that, at 30 DAP germplasm S1010 recorded maximum number of new twigs plant^{-1} (2.04) whereas, it was recorded minimum (1.43) in the germplasm BCSP-14. But at 90 DAP, maximum of number of new twigs plant^{-1} was recorded in the germplasm ST-14 (4.30) and lowest in BCSP-10 (3.36). During 120 DAP maximum of number of new twigs plant^{-1} was registered in S 1010 (2.24) and minimum (0.83) in germplasm 90/101.

Yield parameters

Number, length, diameter and weight

Data presented in Table-3 on different yield parameters of sweet potato indicated that at harvest maximum number of tubers (5.72, 5.40 and 5.56) during first year, second year and mean, respectively were noticed in the germplasm S1010 followed by Kishan (5.71, 4.60 and 5.16) during first year, second year and mean, respectively and germplasm TSP-12-14 recorded minimum (3.65, 3.20 and 3.43) during first year, second year and mean, respectively. Mean maximum tuber length of 17.56 cm was recorded in the germplasm TSP-12-14 whereas, germplasm BCSP-10 and ST-14 recorded mean minimum tuber length of 12.60 cm. In case of tuber diameter germplasm 90/101 recorded mean maximum diameter of 4.88cm followed by S1010 (4.37cm), whereas, Kishan registered minimum diameter of 2.27cm. In case of mean tuber weight, germplasm S1010 recorded maximum tuber weight of 199.02g followed by germplasm 90/101 and ST-14 (180.61g and 180.41g, respectively). However, BCSP-10 (96.31 g) recorded minimum.

Fresh weight, dry weight, yield plot^{-1} and projected yield ha^{-1}

Perusal of 2 years data presented in Table-4 on different yield parameters of sweet potato like fresh tuber weight plant^{-1}, dry weight of tuber per 50g weight, tuber yield plot^{-1} and projected yield ha^{-1} indicated that at harvest mean maximum fresh tuber weight of 391.14g plant^{-1} was found in the germplasm ST-14 followed by S1010 (335.35g) and germplasm BCSP-10 recorded minimum weight of 100.67g plant^{-1}. In case of dry weight of tubers Kishan recorded mean maximum dry weight of 18.64 g per 50g sample followed by BCSP-14 (17.76g) and germplasm ST-14 recorded minimum (8.03g). The mean maximum tuber yield plot^{-1} (9.48kg) was observed in the germplasm S1010 followed by ST-14 (8.10 kg plot^{-1}) whereas, BCSP-10 recorded minimum (2.85kg plot^{-1}). The mean projected tuber yield per hectare was recorded maximum under the germplasm S1010 (15.17 t ha^{-1}) followed by ST-14 (12.96 t ha^{-1}) whereas, minimum in the germplasm BCSP-10 (4.56 t ha^{-1}).

Data presented in Table-5 on projected biomass yield of sweet potato indicated that germplasm BCSP-10, recorded maximum biomass (31.83 t ha^{-1}) and lowest in the germplasm ST-14 (16.34 t ha^{-1}). From the above results it is clear that sweet potato can successfully be grown under the shade of coconut plantation which was duly supported by Potty *et al*. (1979). Nayar and Suja (2004) also opined that tuber crops are the most preferred intercrops in the interspaces of coconut plantation in South India. Nedunchezhiyan and Byju (2005) reported that sweet potato can also be successfully grown as an intercrop in young orchards. Nedunchezhiyan and Naskar (2007) opined that sweet potato variety Samrat proved profitable for intercropping in newly established coconut gardens of Odisha and intercropping of sweet potato did not affect the growth and yield of coconut. Ravi and Saravanan (2012) also reported that the growth rate of sweet potato is strongly influenced by the environmental conditions and the growth rate value of the sweet potato will be higher if the intensity of solar radiation can be utilized optimally by the plants for photosynthesis.

Economics

Data presented in Table- 6 clearly indicated that based upon the gross return incurred from different germplasms coconut equivalent yield (CEY) was recorded highest (6947 numbers) in the germplasm S1010 followed by ST-14 (5936 numbers). Coconut yield was recorded maximum (15400 ha^{-1}) in the germplasm ST-14. In terms of economic return germplasm S1010 recorded maximum B: C ratio of 1.70 with a net economic return of Rs 195647 ha^{-1} available land followed by germplasm ST-14 (1.60, Rs183935 ha^{-1} available land respectively). According to Ghosh *et al.* (2008), among the five different spacings and two corm sizes of elephant foot yam grown as intercrop in 18 years old coconut plantation in West Bengal P_1S_2 (40 x 40 cm, 500 g) recorded maximum cost of cultivation (Rs. 92,891 ha^{-1}), maximum gross return (Rs. 1, 38, 328.ha^{-1}) and net return (Rs. 45,367 ha^{-1}) though maximum benefit: cost ratio (0.85) was observed in P_1S_4 (70 x 70 cm, 300 g) combination.

CONCLUSION

From the above experiment it can be concluded that sweet potato can be profitably grown under the partial shade of a forty years old coconut plantation and based upon the yield and economic returns the performance of the germplasm S1010 is excellent and remunerative with higher B: C ratio (1.70) and higher net return (Rs. 195647 ha^{-1}available land) followed by ST-14 (1.60 and Rs.183935 ha^{-1}available land) under West Bengal.

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REFERENCES

Anonymous, 2020. Horticulture Statistics Division, Dept. of Agriculture, Cooperation & Farmers Welfare, Govt. of India.

Fisher, R.A. and Yates, F. 1974. Statistical Tables for Biological Agricultural and Medical Research. 6th Edn., Longman Group, United Kingdom.

Ghosh, D. K, Hore, J. K, Bandyopadhyay, A. and Maji, M. K. 2008. Effect of spacing and seed corm size of elephant foot yam on economics of a coconut based cropping system. *J. Crop and Weed*, **4**: 15-19.

Gomez, K.A. and Gomez. A.A. 1984**.** Statistical Procedures for Agricultural Research. *John Wiley and Sons, New York,* 680p.

Kumar, A. and Wahid. 1988. Root activity pattern of coconut palm. *Oleagineux*, **43**:337-340.

Kushwah, B.L., Nelliat, E.V., Markose, V.T. and Sunny, A.F. 1973. Rooting pattern of coconut. *Indian J. Agron*., **18**:71-74.

Nair, P.K. 1979. Intensive multiple cropping with coconut in India, Principles-programmes-prospects. Verlag Paul parcy- Berlin and hamburg. Adv. In *Agron and Crop Sci*., **6:** 147 p (ICAF, Nairobi, Kenya).

Nair, P.K.R. and Balakrishnan, T.K. 1976. Pattern of light interception by canopies in coconut-cocoa crop combination. *Indian J. Agric. Sci*., **46**:453-462.

Nayar, T.V.R. and Suja, G. 2004. Production potential of root and tuber crops in multiple cropping systems involving plantation crops. *J. Root Crops*, **30**: 93-100.

Nedunzhiyan, M. and Byju, G. 2005. Effect of planting season on growth and yield of sweet potato (*Ipomoea batatas* L.) varieties. *J. Root Crops*, **31**: 111-114.

Nedunchezhiyan, M. G. and Naskar, S.K. 2007. Sweet potato (*Ipomoea batatas* L.) as an intercrop in a coconut plantation: Growth, yield and quality. *J. Root Crops*, **33**:26-29.

Potty, N.N., Radhakrishnan, T.C. and Asokan, P.K. 1979. A note on the early growth and performance of six varieties of pepper in the multi-storeyed cropping program in coconut gardens. *Agric. Res. J. ,* **17**:151-152.

Ravi, V. and Saravanan, R. 2012. Crop physiology of sweet potato In: Fruit, vegetable and cereal science and biotechnology, published by Global Science Books.