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Assessment of Nutritional Requirement for Food Security in Tropical Islands of India

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A B S T R A C T

The annual food requirement for the projected population for the year 2021 for the tropical South Andaman group of islands was estimated as per guidelines of recommended dietary allowance (RDA). The values suggested are the requirement of 73,750 tonnes of cereals, 16,506 tonnes of pulses, 14,176 tonnes of oil seeds and 54,499 tonnes of vegetables and tubers. The present cropping pattern of the district has a cultivated area of 271.1 ha for cereals (216.1 ha for rice and 55.0 ha for maize), 14.2 ha for pulses (7.2, 6.5 and 0.5 ha for green gram, black gram and arhar respectively), 2.0 ha for oilseeds (1.2 ha for ground nut and 0.8 ha for mustard) and 1460.5 ha for vegetables and tubers (1317.0, 51.5, 46.0, 26.5 and 19.5 ha for vegetables, ginger, sweet potato, tapioca and turmeric respectively) with a total field crop area of 1747.8 ha. As per the present crop productivity and production in these islands, it is nearly impossible to meet the nutritional requirement of the projected population in the year 2021. These informations will help the planners and other stakeholders to have a viable strategy for effective crop planning with judicious use of available land and water resources to achieve food security in these tropical islands.

Introduction

The total food grain production in India has gone up from 50 MT in 1950 to 283.37 MT in 2018-19. Today India produces 115.63 MT of rice, 101.20 MT of wheat and 43.33 MT of coarse grains and 23.22 MT of pulses (Government of India, 2018-19). The requirement of annual food grain of India is estimated as 450 million tonnes by the year 2050 (Patel and Rajput, 2015). The demand-supply scenarios present an alarming situation (Ray and Bhattacharyya (2018).

To meet the food security and nutritional needs of the projected population in 2050, the food production will have to be almost doubled. Management of land and water, may help in savings of significant amounts of water and increase the quality and quantity of

food grain production. In our country, 53% of total food grain production comes from *kharif* season as compared to *rabi* season where the production is around 47% (Maurya *et al.*, 2016). The constraint for food grain production during *kharif* is soil moisture as influenced by the seasonal rainfall from South West monsoon, but in *rabi* season, the constraint for food grain production is minimum temperature and less quantum of stored soil moisture.

Seasonal rainfall accounts for more than 50% of the food grain production in our country (Kumar *et al*., 2004). Variations in the monsoon rainfall affect the total food grain production and also the country's economy, which largely depends on agriculture. Year-to-year fluctuations in summer monsoon rainfall have a strong impact on the variability of aggregate *kharif* food grain production (Parthasarathy *et al*., 1992, Gadgil, 1996, Webster *et al*., 1998). Years with deficient and excess monsoon rainfall are associated with low and high production of food grain, respectively.

But, the negative impact of deficit rainfall is larger than the positive impact of good rainfall (Gadgil and Rupa Kumar, 2006). On this context of dependence of food grain production on climate variability, total food grain requirement for a region is need to be pre estimated for optimal crop planning. The effect of climate on crop production is more pronounced in tropical islands of our countries due to uncertainty of rainfall in crop growing season.

In this study, an attempt has been made to estimate the total food grain production for South Andaman district to sustain food security for the year 2021 so that planners and other stakeholders can formulate an effective crop planning for the area.

Materials and Methods

Study area

South Andaman district is a group of 10 inhabited islands situated in southern part of Andaman and Nicobar group of islands and lies between latitudes of 6° 45´N to 13° 4´ N and longitudes of 92° 15´ E to 94° E at an elevation of 13.0 m from mean sea level. The district comprises of 3 nos. of tehsils and 99 revenue villages and is spreaded in an area of 310.6 thousand ha in Bay of Bengal.

The annual normal rainfall in the district is 3054.2 mm distributed over 131.1 rainy days (Nanda *et al.*, 2018b). The daily rainfall data since last 30 years (1987-2017) indicates that these groups of islands receive 72.5% of the total normal rainfall due to South-West monsoon recorded in 91 rainy days (ICAR-CIARI, 2017; ICAR- KVK, 2018). May to November is the usual wet period, where 90.4% rainfall is recorded in about 117.3 rainy days.

Land use and cropping pattern

The total available land for utilization in the district is 280.4 thousand ha with a net sown area of 6894.19 ha (DSHB, 2009-10). Gross cropped area is 7,141.04 ha and cropping intensity is 104.0%. The total cultivated area is divided in to three types i.e. upland, medium land and low land. Major field crops grown in the district are vegetable, rice, maize, ginger, sweet potato and turmeric (Table 1).

In *kharif*, rice, maize, green gram, black gram, arhar, ground nut, ginger, turmeric, sweet potato, tapioca and off season vegetables are generally grown and in *rabi*, crops like green gram, black gram, ground nut, mustard and vegetable crops are taken. Less number of crops are cultivated in *rabi*

season in these islands due to severe water scarcity and lesser availability of soil moisture (Nanda *et al.*, 2019). Among all the crops, vegetables cover the highest area of 1317 ha followed by rice (216 ha), maize (55 ha), ginger (51.5 ha), sweet potato (46 ha), tapioca (26.5 ha), turmeric (19.5 ha), green gram and black gram (13.7 ha). Ginger, turmeric and tapioca are the crops that are cultivated in these islands due to the climate suitability and more liked by the farmers due to lesser cost of cultivation and more net return (Nanda *et al.*, 2018a). The prevailing cropping pattern and productivity scenario of South Andaman district is given in Table 2.

The past land uses data reveals that the area under cultivation is continuously increasing by converting the fallow land and other uncultivated land to culturable land whereas the area under forest is not much affected. The growing demand for food grain production due to increase in population is a major factor towards it.

Food requirement

Considering the decadal growth rate of 14.23% during 2001 to 2011, the projected population of all the inhabited islands under South Andaman district for 2021 was estimated from the population of 2011. The present scenario of requirement of deficit food grains due to rising population in the study area is met by importing the food grain materials by ship from mainland India, which creates high selling price for the consumers and creates imbalance between demand and supply at many times due to uncertainty of ship sailing schedule.

Recommended dietary allowance (RDA) for adult Indian male and female and infants as suggested by the National Institute of Nutrition (Table 3 and Table 4), (Dietary Guidelines For Indians – A Manual, National Institute of Nutrition, Indian Council of Medical Research, Hyderabad, India) was followed to calculate the edible components of the four major food groups i.e. cereals, pulses, oilseeds and vegetables including tubers required for a projected population in 2021. From the total population, 31% are infants and 69% are adults, hence food requirement is calculated for both infants and adults. Out of total population, 40.08% are workers consisting of 80.1% male and 19.9% female and they were treated as heavy and others were treated as moderate diet consuming humans.

The requirement of edible portion of the individual food crops grown were calculated according to the local affinity as per the present level of production. The net production requirement and the gross production requirement were estimated considering the edible portion in the food grains and the requirements for seeds, feed and wastage, respectively as given in Table 5.

Results and Discussion

Projected population

The total population of the district is 2,38,142 consisting of 1,27,283 males and 1,10,859 females as per 2011 census. Out of the total population, 40.66% are workers and among the total workers, 80.1% are male and 19.9% are female. The present decadal growth rate is 14.23% and as per this, the projected population of the district in 2021 is 2,72,029 comprising of 1,45,395 males and 1,26,634 females.

Food grain requirement

The prescribed guidelines of recommended dietary allowance (RDA) for Indians by National Institute of Nutrition, Hyderabad (NIN, 1998; NIN, 2011) is followed to estimate the annual food requirement of the district for the projected population and is

given in Table 6. The net production requirement of the individual food grain is calculated based on the edible portion of the food items, and the gross production requirements are calculated considering the requirements of seeds, feed and wastage. The estimated net food grain requirement, net production requirement and gross production requirement as per recommended dietary allowance for men and women separately are given in Table 7. A comparative study between the food grain production in 2015-16 and required food grain 2021 is presented in Figure 1. As evident from the figure, the requirement of food grain is much higher than the present level of production for all the food groups. At present the net food grain requirement for the present population also not able to meet from the production from the field crops being cultivated in these islands alone. The deficit food grains are being imported from the mainland India by the Andaman and Nicobar Administration. This puts a heavy pressure on the Government to meet the demand as of now.

Table.1 Land use pattern of the South Andaman district

Sl. No.	Land use	Area, ha
1	Total geographical area	310600.00
2	Reporting area for land utilization	280442.46
3	Forest area	267294.00
4	Not available for cultivation	2729.48
5	Current fallow	342.75
6	Other uncultivated land excluding fallow land	1860.98
7	Fallow land other than current fallows	1321.06
8	Net area sown	6894.19
9	Area available for cultivation	10418.98

Source: DSHB, 2009-10

Table.2 Prevailing crops and their productivity scenario in South Andaman district

Sl. No.	Crops	Cultivated Area, ha	Percent of total cultivated area	Yield, q/ha
1	Rice	216.1	12.36	30.46
2	Maize	55.0	3.15	20.27
3	Green gram	7.2	0.41	3.13
4	Black gram	6.5	0.37	2.77
5	Arhar	0.5	0.03	4.00
6	Ground nut	1.2	0.07	5.00
7	Mustard	0.8	0.05	8.13
8	Ginger	51.5	2.95	84.99
9	Turmeric	19.5	1.12	66.46
10	Sweet Potato	46.0	2.63	96.74
11	Tapioca	26.5	1.52	273.58
12	Vegetables	1317.0	75.35	64.16

Source: DSHB, 2015-16

Table.3 Recommended Dietary Allowance (RDA) for Indian adult male and female

Sl. No.	Food groups	gm/ portion	Recommended Dietary Allowance							
			Moderate				Heavy			
			Male		Female		Male		Female	
			Nos. of portions	Gm per day	Nos. of portions	gm per day	Nos. of portions	gm per day	Nos. of portions	gm per day
1	Cereals and millets	30	15	450	11	330	20	600	16	80
2	Pulses	30	3	90	2.5	75	4	120	3	90
3	Fats and oils	5	6	30	5	25	8	40	6	30
4	Roots and tubers	100	2	200	2	200	2	200	2	200
5	Green leafy vegetables	100	1	100	1	100	1	100	1	100
6	Other vegetables	100	2	200	2	200	2	200	2	200

Source: http://www.ninindia.org/DietaryguidelinesforIndians-Finaldraft.pdf (Dietary Guidelines For Indians – A Manual, National Institute of Nutrition, Indian Council of Medical Research, Hyderabad, India)

Table.4 Recommended dietary allowance (RDA) for Indian infants

Sl. No.	Food groups	gm / portion	Recommended Dietary Allowance (Nos. of portions) for infants										
			6-12 months	1-3 years	4-6 years	7-9 years	10-12 Years		13-15 years		16-18 years		Avg
							F	M	F	M	F	M	
1	Cereals and millets	30	0.5	2	4	6	8	10	11	14	11	15	6.7
2	Pulses	30	0.25	1	1	2	2	2	2	2.5	2.5	3	1.6
3	Fats and oils	5	4	5	5	5	5	5	5	5	5	5	6.3
4	Roots and tubers	100	0.5	0.5	1	1	1	1	1	1.5	2	2	1
5	Green leafy vegetables	100	0.25	0.5	0.5	1	1	1	1	1	1	1	0.8
6	Other vegetables	100	0.25	0.5	1	1	2	2	2	2	2	2	1.3

Table.5 Edible portion, local affinity and requirement towards seed, feed and losses of food items

Sl. No.	Food items	Edible portion (% of whole grain)	Local affinity (% of food group)	Requirement towards seed, feed and wastage (% of gross production)
	Cereals			
1	Rice	66	80	22
2	Maize	78	20	22
	Pulses			
3	Green gram	70	51	30
4	Black gram	70	46	30
5	Arhar	70	3	30
	Oilseeds			
6	Groundnut	28	36	25
7	Mustard	33	64	25
	Tuber crops and vegetables			
8	Sweet potato	100	63	20
9	Tapioca	100	37	20
10	Vegetables	100	100	20

Table.6 Food group wise production requirement as per RDA for the projected population of South Andaman district during 2021

Sl. No.	Food groups	Net food requirement (Tonnes)	Net production requirement (Tonnes)	Gross production requirement (Tonnes)
1	Rice	31338	47481	60873
2	Maize	7834	10044	12877
	Cereals	**39172**	**57525**	**73750**
3	Green gram	4125	5893	8418
4	Black gram	3720	5315	7593
5	Arhar	243	347	495
	Pulses	**8088**	**11555**	**16506**
6	Ground nut	1901	6791	9054
7	Mustard	1268	3841	5122
	Oil seeds	**3169**	**10632**	**14176**
8	Vegetable	26709	26709	33386
9	Sweet potato	10641	10641	13301
10	Tapioca	6249	6249	7812
	Vegetables and tubers	**43599**	**43599**	**54499**
	Total	**94028**	**123311**	**158931**

Table.7 Requirement of food materials as per recommended dietary allowance for the projected population of South Andaman district during 2021

Sl. No.	Category	Population as per 2011 census	Projected population in 2021	Projected infant population in 2021	Projected adult population in 2021	Projected workers population in 2021	Projected others population in 2021	Projected annual net food requirement in 2021, Tonnes				Remarks
								Cereals and millets	Pulses	Fats and oils	Vegetables and tubers/roots	
1	Male	127283	145395	45072	100323	58274	42049	22982	4727	1828	23303	Workers taken as heavy and others taken as moderate for calculation of food requirement
2	Female	110859	126634	39257	87377	50755	36622	16190	3361	1340	20296	
Total		238142	272029	84329	187700	109029	78671	39172	8088	3168	43599	

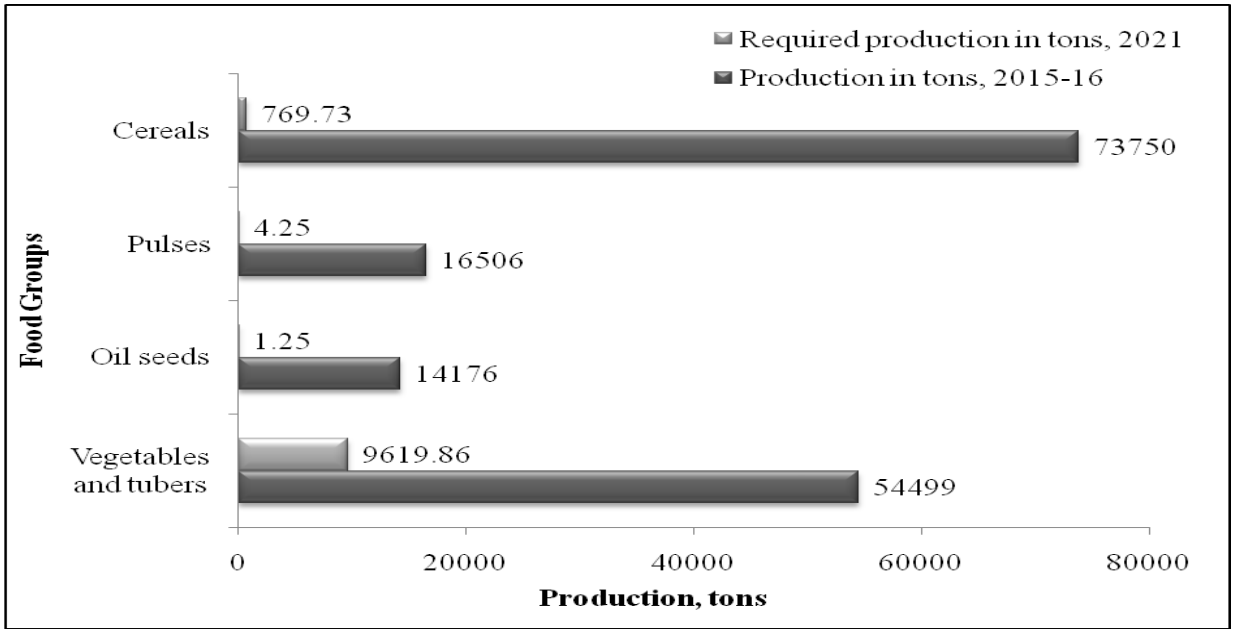

Fig.1 Comparison of production and requirement of different food groups in 2015-16 and 2021 respectively

With rise in population at a rate of 14.23% as decadal growth rate, the production level for all the crops need to be improved. Being isolated from the mainland India and with the fragile island ecosystem, for these islands it is nearly impossible to meet the food grain requirement from the projected population.

But with improved agricultural practice, introduction of high yielding varieties and bringing more areas to cultivation can able to meet a large percent of the food grain production.

The annual food requirement of the South Andaman district comprising of 10 inhabited islands for the projected population of 2,72,029 for the year 2021 was estimated to be 73,750 tonnes of cereals, 16,506 tonnes of pulses, 14,176 tonnes of oil seeds and 54,499 tonness of vegetables and tubers. To meet the food grain requirement improved agricultural practice, introduction of high yielding varieties and bringing more areas to cultivation are the policies need to be adopted by the policy makers and other stake holder so that food security can be achieved in these group of islands.

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