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Identification of Suitable Alternate *Rabi* Crops for Coastal Sands of Nellore District

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ABSTRACT

Background: Groundnut (*Arachis hypogaea* L.), is a leguminous crop which is widely cultivated in the tropics and subtropics between 40°N and 40°S latitudes. It is valued for its high-oil edible seeds and as such it is the fourth most important source of edible oil and third most important source of vegetable protein in the world. Groundnut is not only an important oilseed crop of India but also an important agricultural export commodity. Cultivation of groundnut is an alternate occupation to fishing by the fisherman in the coastal sands. Farmers are cultivating groundnut after groundnut for the past two decades resulting in low income from the crop. Based on their demand a field experiment is planned to identify alternate crops which are remunerative to this tract.

Methods: Field experiment entitled "Identification of suitable alternate *Rabi* crops for coastal sands of Nellore district" was carried out for two consecutive years during *rabi*, 2017-18 and 2018-19 on farmer's field at Srigowripuram, Vidavalur Mandal, SPSR Nellore district.

Result: The mean performance revealed that all the crops produced less groundnut equivalent yields than groundnut crop. Groundnut pod equivalent yield was reduced by 4.60%, 71.25%, 90.14% and 55.78% in water melon, musk melon, onion and potato crops respectively. In terms of groundnut pod equivalent yield no crop is found superior to existing groundnut crop. With regard to alternate crops, the maximum groundnut pod equivalent yield (4941.50 kg ha^{-1}) was noticed in water melon crop followed by muskmelon (1489.50 kg ha^{-1}). Though higher gross and net returns were realized for groundnut (284955, 200695 Rs ha^{-1}) B:C ratio was found to be maximum for water melon (3.48) due to low cost of cultivation Hence, water melon crop can be promoted as a remunerative crop alternate groundnut in coastal sands of Nellore district. Whereas, onion crop was found to be least in monitory returns crop with lower productivity in costal sands of Nellore district.

Key words: Alternate *rabi* crops, Coastal sands, Groundnut pod equivalent yield.

INTRODCUTION

The coastline of India is approximately 8,000 km and in Andhra Pradesh it is to extent of 792 km and is dominated by sandy soils. People living in this jurisdiction of sea coast thrive mostly on fishing rather than cultivating agricultural crops. Due to climate change number of dead zones are increasing, leading to poor fish availability within 1 km area of sea and they have to venture up to 30 km away into sea to catch fish, which is difficult for marginal and poor fisherman. Hence, there is a shift occupation from fishing to agriculture by marginal and poor farmers for two years. Nellore district is one of the coastal districts it's situated in the south eastern part of Andhra Pradesh with vast coastline across the length. Groundnut is an important oilseed crop grown during *rabi* on coastal sands by the farmers of Nellore district. The analysis of land capability and land suitability resources based on physical aspects using Survey of India topographic sheets, IRS P6 LISS-III data on scale 1:50,000 revealed that maize, black gram, green gram, mesta, ragi in seethanagaram, Bobbili, Bajipeta, Bhogapuram, Nellimarla coastal areas of Vizianagaram district of Andhra Pradesh (Raju, 2015).

Major constraints limiting crop production on coastal sands are poor nutrient status, high leaching and low soil organic matter along with reduced microbial activity. Coastal sands contain more than 80% sand with poor soil structure, low water holding capacity, high permeability and fast drainage, with low nutrients (Martini and Hendrata, 2008). Further, FAO classified coastal sandy soils as unsuitable for food and vegetable, but recent research shows that soil treatments to these soils can improve plant yields (Muchtar and Soelaeman., 2010).

Among the crops, groundnut is one of the major crops grown by coastal farmers in the nutrient impoverished soils with relatively very poor yield due to lack of proper agronomic interventions. Yield of groundnut may vary and sometimes lead to drastic reduction due to incidence of diseases as the micro climate of crop favors pest and diseases due to sprinkler irrigation. Though, the coastal sand farmers of Nellore district were invariably growing groundnut crop, they are not able to get minimum returns due to market rate fluctuations besides high cost of cultivation. Costal sand

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peanut production is not as profitable, the change forced many farmers to abandon peanut production and look for alternative crops. In the changing scenario of climatic/crop vagaries it is an urgent need to identify suitable alternate remunerative crop to groundnut for getting higher returns. Selection of commercial crops with low cost of cultivation and high remuneration is needed to be evolved to stabilize the income of coastal sand groundnut farmers. Hence efforts were made on the right crop and suitable agro techniques to sustain yields under these conditions. It is worth noting that these techniques can be used in coastal sandy soils of A.P as well as other parts of country and benefit is scalable. The overall objective of this research endeavor is to increase the ability of farmers to make more informed decisions related to changes in the farm operations. The specific objective is to determine risk efficient crop alternatives to groundnut in costal sands during *rabi*.

MATERIALS AND METHODS

The field experiment "Identification of suitable alternate *Rabi* crops for coastal sands of Nellore district". was carried out for consecutive two seasons during *rabi*, 2017-18 and 2018-19 on farmer's field at Srigowripuram (14.6324°N, 80.1506°E), Vidavalur Mandal, SPSR Nellore district. This region falls in SAT with a mean annual precipitation of around 984 mm. The soils of experimental field are purely costal sands. Composite soil samples were collected from the experimental field before sowing and they were analyzed. The results of the soil sample analysis and the methods followed are presented in Table 1. The soils are neutral in reaction with safe EC limits.

Organic carbon and available nitrogen and potassium were low and high in available phosphorus. The soil was low in organic carbon, low in available nitrogen, high in available phosphorous, low in available potassium. The soil was medium in available sulphur, medium in calcium and deficient in magnesium. Major constraints limiting crop production on coastal sands are poor nutrient status, high leaching and low soil organic matter along with reduced microbial activity. Meteorological data was also recorded nearby Agricultural Research Station, Nellore (Fig 1 and Fig 2).

The field experiment was laid out in a Randomized Block Design (RBD) with four replications. The treatments consisted of five crops *viz.,* Groundnut, watermelon, muskmelon, onion and potato. The main objective of the field experiment is to identify suitable remunerative crop alternate to groundnut in coastal sands of Nellore and to enhance the income of farmer with minimum cost of production. Crop specific recommended dose of fertilizers were applied at different intervals. Cultural operations were carried out as per the recommendation. Plant protection measures were adopted when required. Irrigation was given through micro sprinklers with a discharge of 5 ha mm depth in 30 minutes. The quantity of irrigation given and no of irrigations were recorded to quantify the irrigation water given to the crop during crop season. Each time the micro sprinklers were ran for 3 hours to give a depth of 30 ha mm of water to crops and the each run time was counted as a one irrigation. Crop water use efficiency was calculated to each crop in season. Groundnut pod equivalent yield data was statistically analyzed following the analysis of variance for RBD as suggested by Gomez and Gomez (1984). Statistical significance was tested with 'F' test at 5 per cent level of probability and compared the treatment means with critical difference. For calculating groundnut pod equivalent yields, the prices of various produce as taken as *viz.*, groundnut- Rs 55 kg^{-1}, watermelon Rs 5 kg^{-1}, muskmelon Rs 12 kg^{-1}, potato Rs 8 kg^{-1} and onion Rs 15 kg^{-1}.

RESULTS AND DISCUSSION

Yield attributes and yield of groundnut and alternate crops were recorded during rabi (Table 2 and 3). Results revealed that (Table 4) all the alternate crops registered less ground nut pod equivalent yields than groundnut crop. Groundnut

Table 1: Initial soil status of coastal sands of Srigowripuram, Vidavalur (M), SPSR Nellore district during *Rabi,* 2017-18.

Particulars	Values	Status
pH	7.10	Neutral
EC	0.181	Saline
Organic carbon (%)	0.15	Low
Available N (kg ha^{-1})	213	Low
Available P_2O_5 (kg ha^{-1})	96	High
Available K_2O (kg ha^{-1})	108	Low
Available S (ppm)	13	Medium
Available Ca (Cmol (+) kg^{-1})	4.4	Medium
Available Mg (Cmol (+) kg^{-1})	1.2	Deficient

Table 2: Yield attributes and yield of groundnut.

Treatment	T1
Crop	Groundnut
100 pod weight (g)	100
100 kernel weight (g)	50
Shelling percentage	76
Pod yield (kg ha^{-1})	5130
Haulm yield (kg ha^{-1})	3300
Harvest index	0.6
Plant population m^{-2}	31

Table 3: Yield attributes and yield of alternative crops.

Crop	No. of Fruits, tubersor bulbs $plant^{-1}$	Weight (kg) of fruit, tuberor bulb	Yield (kg ha^{-1})	Plant population m^{-2}
T2- Watermelon	2.4	1.21	58080	2
T3- Muskmelon	2.5	0.335	16750	2
T4- Onion	1	0.033	3326	10
T5- Potato	9	0.028	24930	10

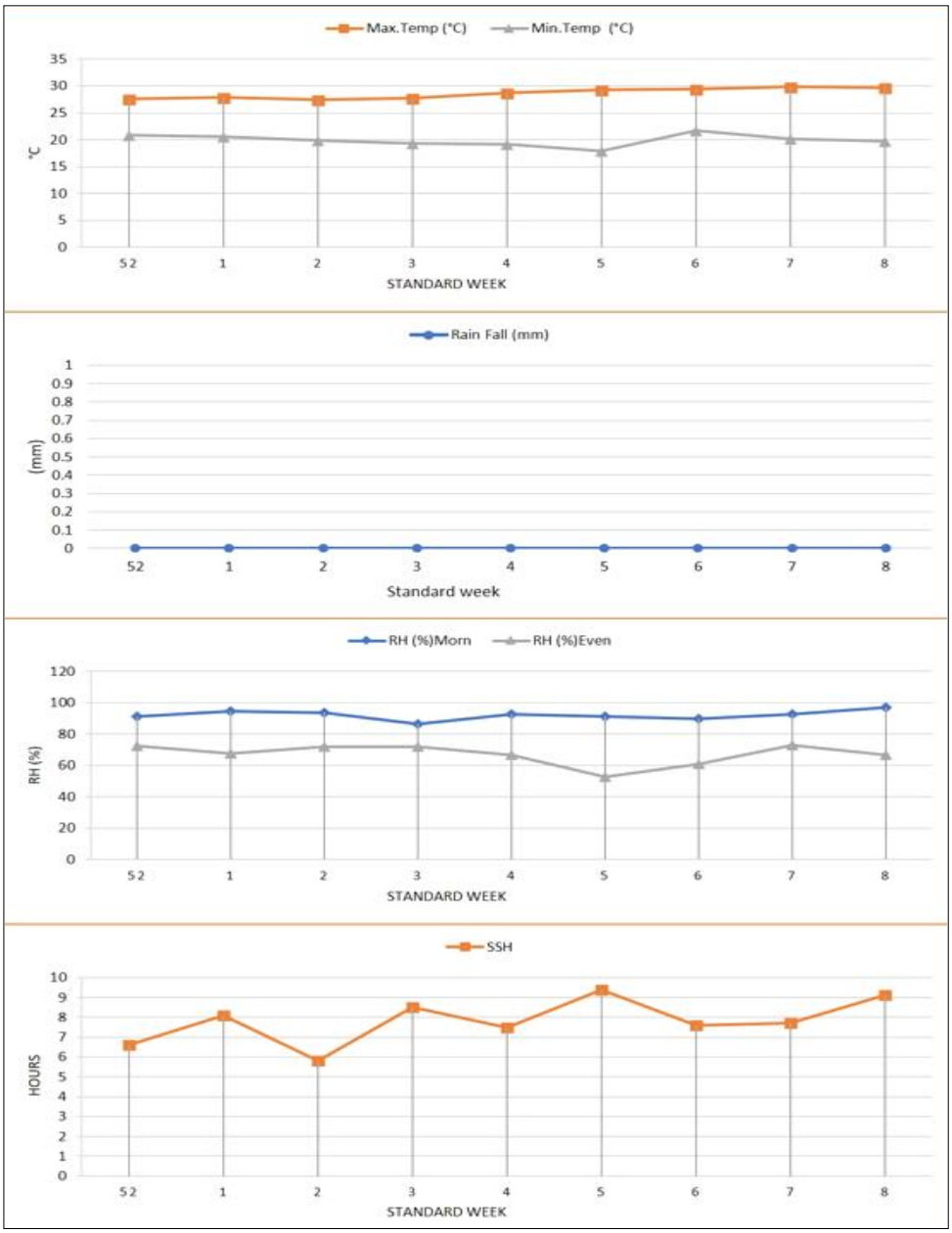

Fig 1: Meteorological data recorded during 2017-18.

Table 4: Performance of crops under coastal sands of Nellore District.

Treatments	Yield (kg ha^{-1})			Groundnut ppod equivalent yield (Kg ha^{-1})		
	2017-18	2018-19	Mean	2017-18	2018-19	Mean
T1- Groundnut (Check)	5130	5232	5181.00	5130	5232	5181.00 (0.00%)
T2- Watermelon	58080	50635	25611.50	5280	4603	4941.50 (-4.60%)
T3- Muskmelon	16750	16030	16390.00	1522	1457	1489.50 (-71.25%)
T4- Onion	3326	3699	3512.50	483	538	510.50 (-90.14%)
T5- Potato	24930	25465	25197.50	2266	2315	2290.50 (-55.78)
SEm ±	-	-	-	50.4	64.5	61.6
CD (P=0.05)	-	-	-	136	187	178

Figures in parenthesis are percentage over groundnut crop.

Fig 2: Meteorological data recorded during 2018-19.

pod equivalent yield was reduced by 4.60%, 71.25%, 90.14% and 55.78% in watermelon, muskmelon, onion and potato crops respectively. The maximum groundnut pod equivalent yield (4941.50 kg ha^{-1}) was recorded in watermelon crop followed by muskmelon (1489.50 kg ha^{-1}) (Table 4). In terms of groundnut pod equivalent yield no crop is found superior to existing groundnut crop. This was due to prevailing higher market price of the produce of groundnut. The results were in consonance with Devkota *et al.,* (2006); Sadashivana Gowda *et al.,* (2020). However, data (Table 5) pertaining to monetary returns clearly indicated that growing watermelon is the most profitable alternative with the net returns of 200695 Rs ha^{-1} followed by potato (58952 Rs ha^{-1}).

This might be owed to cost of cultivation was higher for production of groundnut (84260 Rs ha^{-1}). The relatively cost of cultivation was lower to water melon (77995 Rs ha^{-1}), musk melon (77995 Rs ha^{-1}) and potato (67025 Rs ha^{-1}). Similar results of economic benefits have been reported by Prasad and Singh (2002) in sunflower, Thavaprakash and Malligawad (2002) in sunflower, Reddy *et al.* (2002) in sunflower and Anand (2010) in chickpea and maize.

Different alternative crops to groundnut were evaluated to economize and sustain productivity. The mean analysis

Table 5: Economics of crops under coastal sands of Nellore District.

Treatments	Cost of cultivation (Rs ha^{-1})			Gross returns (Rs ha^{-1})			Net returns (Rs ha^{-1})			B:C ratio		
	2017-18	2018-19	Mean	2017-18	2018-19	Mean	2017-18	2018-19	Mean	2017	2018	Mean
T1- Groundnut (Check)	84260	84260	84260	288750	291060	289905	204490	206800	205645	3.43	3.45	3.44
T2- Watermelon	77995	77995	77995	290400	253175	271788	212405	175180	193793	3.72	3.24	3.48
T3- Muskmelon	77995	77995	77995	201000	192360	196680	123005	114365	118685	2.58	2.46	2.52
T4- Onion	54832	54832	54832	49890	55485	52687.5	-4942	653	-2144.5	0.91	1.01	0.96
T5- Potato	67025	67025	67025	199440	203720	201580	132415	136695	134555	2.98	3.04	3.01
SEm±	1483.1	1057.8	1472.0	3385.7	2644.4	3114.5	3385.7	2644.4	3114.5	0.114	0.108	0.099
CD (P=0.05)	4301	2856	4254	9785	7140	9032	9785	7140	9032	0.16	0.15	0.14

Table 6: Irrigation studies on different alternate crops under coastal sands of Nellore district.

Crop	Irrigation requirement (mm)	No. of irrigations given	Each irrigation depth (mm)	Actual depth of irrigation given (mm)	Yield of crops (kg/ha)	Water use efficiency (Kg-ha mm^{-1})
Groundnut	550	26	30	780	5181	6.64
Watermelon	450	22	30	660	4942	7.49
Muskmelon	430	19	30	570	1490	2.61
Onion	550	20	30	600	511	0.85
Potato	650	21	30	630	2291	3.64

indicated that, in terms of net returns, higher values were obtained with watermelon (193793 Rs ha^{-1}) followed by potato (134555 Rs ha^{-1}) and muskmelon (118685 Rs ha^{-1}). Significantly lower B:C ratio was noticed with watermelon (3.48) followed by potato (3.01) and musk melon (2.52) in the order of descent. Negative net returns and lower B:C ratio were recorded with onion even under low cost of cultivation due to lower productivity. The maximum monetary returns for watermelon then groundnut is due to low cost of cultivation (Table 5).

The highest actual depth of irrigation (780 ha-mm) was given to the groundnut followed by watermelon (660 ha-mm), onion (600 ha-mm), potato (630 ha-mm) and muskmelon (570 ha-mm) in the coastal sands of Nellore district. Among the different crops tested highest number of irrigations were given to groundnut (26 irrigations of each 30 mm and micro irrigation sprinklers ran for 3 hours is considered as a one irrigation) followed by watermelon, potato, onion and muskmelon with 22, 21, 20 and19 irrigations respectively (Table 6). Singh *et al.*, 2014 reported that pod yield increased with increasing frequency of irrigation of irrigation water to a depth of 600 ha-mm and recorded highest WUE. Among the different crops tested highest water use efficiency was with watermelon @ 7.49 kg ha mm^{-1} followed by groundnut (6.64 kg ha mm^{-1}), potato (3.64 kg ha mm^{-1}), muskmelon (2.61 kg ha mm^{-1}) and lowest was recorded with onion (0.85 kg ha mm^{-1}).

CONCLUSION

This study examined the alternatives to groundnut in coastal sands of Nellore district. The pooled data of two years revealed that watermelon crop is a suitable alternative crop for groundnut because of its higher B:C ratio, higher WUE and low cost of cultivation compared to groundnut. Onion crop is found to be least remunerative crop for coastal sands in Nellore district.

Conflict of interest: None.

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