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Evaluation of time, method of sowing and varieties for table-purpose groundnut (*Arachis hypogaea*) under Island ecosystem

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ABSTRACT

A study was conducted during dry season of 2007–09 at Andaman and Nicobar Islands to evaluate the time, method of sowing and varieties for table-purpose of groundnut (*Arachis hypogaea* L.) under Island conditions. Experiment was laid out in split-plot design by assigning method of sowing (manual line sowing and manual dibbling) in main plot and 3 time of sowing (24 December, 7 January, 22 January) with 2 varieties ('SG 99' and 'ICGS 76') in sub-plots and replicated thrice. Growth, yield parameters and yield were not significantly influenced by method of sowing. However early sowing, 24 December registered significantly higher pod yield (3 979 kg/ha) which is at with sowing, ie in first week of January (3 838 kg/ha). Delayed sowing, 22 January gave significantly lower yield as terminal phase of crop growth coincided with onset of rainfall. Similarly, early sowing of 24 December recorded significantly higher net returns (Rs53 040/ha) and B: C ratio (2.5). Both the varieties 'SG 99' and 'ICGS 76' performed equally in terms of yield and economics. Higher energy ratio (25.8) and lower specific energy (3.3 MJ/kg) was recorded with December sowing.

Key words: Island ecosystem, Table-purpose groundnut, Time of sowing, Varieties

Andaman and Nicobar Islands are located in Bay of Bengal having 43 500 ha of area under cultivation. Around 7 685 ha of area is under paddy cultivation during wet season (ANA 2008). After the harvest of paddy, lands were either left fallow or little area is grown with blackgram (*Vigna mungo* L. Hepper), greengram [*Vigna radiata* (L.) R. Wilczck] or vegetables, like okra [*Abelmoschus esculentus* (L.) Moench] and chilli (*Capsicum annum* L.). Since Island receives almost 3 000 mm annual average rainfall from May to November, utilization of residual moisture for crop growth is essential for which timely sowing is must. Table-purpose groundnut, also called as hand picked and selected groundnuts has great marketing potential in Islands as it can be used in many forms, like boiled peanuts, fried nuts etc. for tourists along with value of green haulms as fodder for animals. Table-purpose groundnuts have very large market in India as well as abroad. Apart from major use for edible oil, they are consumed in large quantities in individual house also. Processors making salted peanuts, some chocolate manufacturers, peanut butter manufactures etc. are the bulk consumers. Rama Devi *et al.* (2000) reported that food from grain/pods and fodder from the crop residues almost equally contribute to livelihoods in mixed-crop livestock systems. Considering the potential value and use of table-purpose groundnut along with its suitability to island soil conditions, a study was conducted with an objective to evaluate time, method of sowing and varieties of table-purpose groundnut for its yield, economics and energetic under Island conditions.

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MATERIALS AND METHODS

Field experiments were conducted during dry season of 2007–09 at field crop research farm of the Institute, Port Blair to evaluate time, method of sowing and varieties for table purpose groundnut. The soil was sandy loam having neutral *p*H (6.8), medium in organic carbon (0.56%), available N (278.2 kg/ha), phosphorus (18.3 kg/ha) and potassium (186.4 kg/ha). The rainfall received during the crop growth period was 707.5 and 202.3 mm in 2007–08 and 2008–09 respectively. Experiment was laid out in split plot design with 3 replications. Two method of sowing (manual line sowing and manual dibbling) were assigned to main plot while 3 time of sowing (26 December, 7 January and 22 January) and 2 varieties ('SG 99' and 'ICGS 76') were assigned to sub-plots. In both the methods of sowing,

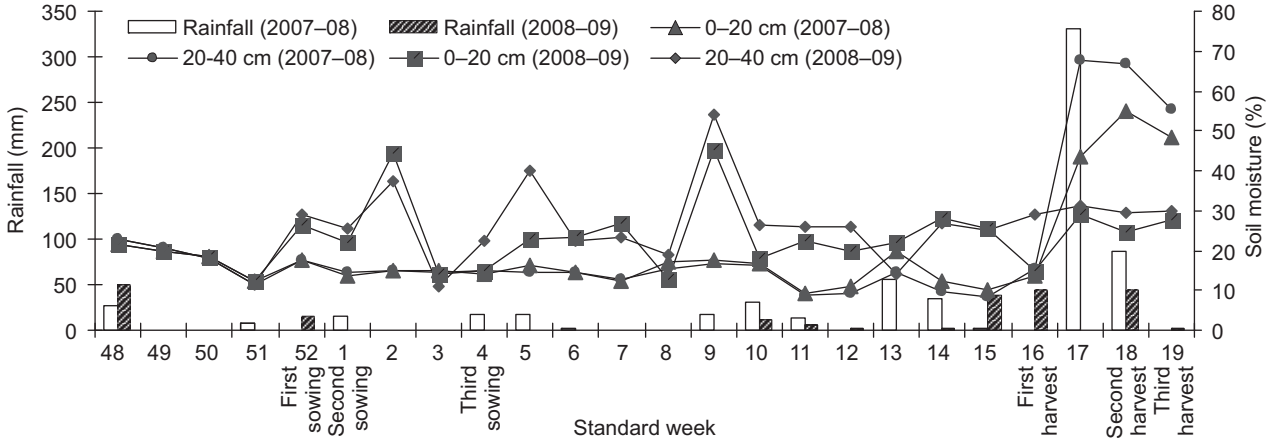

Fig 1 Soil moisture pattern (2007–08 and 2008–09) during crop growth period of table-purpose groundnut

30 cm × 10 cm spacing was adopted for both the varieties. Before the main experiment, evaluation of 11 varieties of table-purpose groundnut obtained from Directorate of Groundnut Research, Junagadh, International Crops Research Institute for Semi Arid Tropics, Hyderabad and Bhabha Atomic Research Centre, Trombay were evaluated in randomized block design during 2006–07. Based on the performance, 'SG 99' and 'ICGS 76' varieties were selected for the evaluation with time and method of sowing. Since regular rainfall was received during 2007–08, only one irrigation of 5 cm depth was given at pegging stage. However, in 2008–09, 4 irrigations at 5 cm depth, each were given at life (3 days after sowing), pegging, flowering and pod formation stages. The mean soil temperature during 26 December was 28.4°C, 26.6°C and 27.1°C at 5, 15 and 30 cm depth respectively while it was 27.7°C, 26.8°C and 26.9°C in January at the same depths. Recommended dose of 20:30:20 kg NPK/ha was applied as basal dose in the form of urea, single superphosphate and muriate of potash. As there was no pest or disease attack, no spraying was done. All the other recommended packages were adopted as per schedule. Soil samples were collected at 0–20 and 20–40 cm depth at weekly intervals and moisture content was estimated in oven dry method. Observations on growth, root and yield parameters were recorded at harvest stage as per standard procedures. As demand for green fodder is high in Islands during dry season, green haulm yield was recorded along with dry pod yield. Observations on soil moisture pattern during the crop growth period were recorded at 0–20 cm and 20–40 cm depth using gravimetric method. Economics were calculated. Output energy was calculated by assigning the energy value of 25 MJ/kg for dry pods and 10 MJ/kg for green haulms. Energy ratio was calculated using the formula of output energy divided by input energy, while specific energy was calculated by using the formula of input energy divided by dry pod yield and expressed in MJ/kg (Mittal *et al.* 1985). All the observations were statistically analyzed for its test of significance in the individual years and pooled over years through standard procedures.

RESULTS AND DISCUSSION

Soil moisture pattern

Rainfall of 27.2 and 49.8 mm was recorded in 48th standard week of 2007–08 and 2008–09, respectively which made soil unsuitable for field preparation up to 50th standard week in both the years. Soil was suitable for preparation of sowing when it attained the moisture content of < 20% in 51st standard week. Hence, the sowing of dry season crops can be taken up during 52nd standard week only (Fig 1) under Island conditions. Since table-purpose groundnut comes to maturity in 105–110 days, the sowing in 52nd standard week escaped from onset of rainfall coinciding with harvest. However, sowing in standard week number 4 (22 January) led to waterlogging in the field at harvesting stage due to onset of monsoon in both the years. Soil moisture was in the range of 12 to 20% throughout the crop growth cycle during 2007–08, while it was higher in 2008–09 due to staggered rainfall. Pramanik *et al.* (2000) also reported that sowing of dry season crops is possible only in last week of December under island conditions.

Growth attributes

Method of sowing did not significantly influence the growth parameters such as plant height, number of branches/plant, root length and shoot length in both the years (Table 1). Time of sowing significantly influenced the number of branches/plant. Early sowing (24 December) registered significantly more number of branches/plant (14.7) which is at par with 7 January sowing (13.0). However delayed sowing (22 January) recorded significantly lower number of branches/plant (9.9). Time of sowing did not influence other growth parameters. No significant difference in growth parameters was observed between 2 varieties namely 'SG 9' and 'ICGS 76' which might be due to similar morphological characters possessed by these varieties. It corroborates the findings of Karanjikar *et al.* (2004).

Table 1 Influence of method, date of sowing and varieties on growth and yield attributes of table purpose groundnut (mean of 2 years)

Treatment	Plant height (cm)	Branches/ plant	Root length (cm)	Shoot length (cm)	Pods/ plant	Pod weight/ plant (g)	100-pod weight (g)	Shell weight/ plant (g)	Kernels/ plant	Kernel weight/ plant (g)	100-kernel weight (g)	Shelling (%)
Method of sowing												
Manual line sowing	57.2	12.5	11.8	57.2	24.6	48.5	204.4	18.1	37.9	29.8	82.5	63.3
Manual dibbling	61.6	13.0	12.8	61.5	28.1	57.7	211.4	27.4	44.8	35.6	85.5	61.2
SEm±	2.1	0.7	0.6	2.1	1.8	4.0	7.7	3.0	0.1	0.1	4.3	1.6
CD (*P*=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	0.5	1.0	NS	NS
Time of sowing												
24 December	58.3	14.7	12.8	58.3	30.3	55.6	208.7	18.0	44.8	37.1	72.3	67.3
07 January	59.0	13.0	11.9	59.0	28.5	55.6	202.7	26.4	45.3	34.0	69.4	62.3
22 January	60.9	9.9	12.3	60.9	20.4	48.1	212.3	23.5	33.4	27.1	65.9	57.1
SEm±	2.2	1.1	0.6	2.2	2.0	4.2	7.0	2.9	4.7	2.9	2.9	2.3
CD (*P*=0.05)	NS	3.1	NS	NS	5.9	12.4	NS	8.5	12.8	8.6	8.4	6.5
Varieties												
'SG 99'	59.6	11.9	12.9	59.6	26.3	52.5	203.9	20.3	39.3	32.2	68.4	61.4
'ICGS 76'	59.2	13.1	11.8	59.2	26.3	53.7	212.0	25.0	43.2	33.0	69.7	62.8
SEm±	1.8	0.8	0.5	1.8	3.8	3.5	5.7	2.4	3.8	2.4	2.3	1.8
CD (*P*=0.05)	NS	NS	NS	NS	NS	NS	17.1	7.0	NS	NS	NS	NS

Pod parameter

Method of sowing significantly influenced the pod weight/ plant and shell weight/plant in 2007–08 only. Manual dibbling registered higher pod weight (77.0 g/plant) and shell weight (41.0 g/plant) (Table 1) compared to manual line sowing. However, it failed to influence on number of pods/plant and 100-pod weight. Time of sowing had significant influence on number of pods/plant, pod weight/plant and shell weight/ plant. Early sowing recorded higher number of pods/plant (30.3), and pod weight (55.6 g/plant) and lesser shell weight (18 g/plant), followed by 7 January sowing. Delay in sowing up to 22 January led to significantly lower pod parameters. Time of sowing failed to exert any influence on 100-pod weight. Among the varieties, 100 pod weight was more in 'ICGS 76' (212 g) than 'SG 99' (203.9 g). However, the shell weight was lesser in 'SG 99' variety. Number of pods/plant and pod weight/plant was not influenced by varieties. Naeem Ahmad and Muhammad Rahim (2007) reported that January sowing recorded lesser yield parameters, especially number of pods/plant which is due to lower value of crop water-use efficiency.

Kernel parameters

Method of sowing significantly influenced the number of kernels/plant and kernel weight/plant (Table 1) while it failed to exert influence on 100-kernel weight and

Table 2 Influence of method, date of sowing and varieties on yield of table-purpose groundnut

Treatment	Dry pod yield (kg/ha)			Green haulm yield (kg/ha)			Harvest index		
	2007–08	2008–09	Mean	2007–08	2008–09	Mean	2007–08	2008–09	Mean
Method of sowing									
Manual line sowing	3 612	3 742	3 677	22 112	20 459	21 286	0.15	0.16	0.16
Manual dibbling	3 866	3 802	3 834	23 369	21 605	22 487	0.15	0.15	0.15
SEm±	98	211	154	1 169	1 649	1 409	0.01	0.01	0.01
CD (*P*=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
Time of sowing									
24 December	3 881	4 076	3 979	28 737	23 413	26 075	0.12	0.19	0.16
07 January	3 765	3 910	3 838	24 273	22 222	12 348	0.14	0.15	0.15
22 January	3 571	3 329	3 450	15 212	17 460	16 336	0.20	0.13	0.17
SEm±	85	152	119	1 498	941	1 220	0.01	0.01	0.01
CD (*P*=0.05)	250	448	349	4 420	2 776	3 598	0.02	0.02	0.02
Varieties									
'SG 99'	3 741	3 750	3 746	2 3369	21 076	22 223	0.14	0.15	0.15
'ICGS 76'	3 737	3 794	3 766	2 2112	20 988	21 550	0.16	0.16	0.16
SEm±	127	124	126	1223	769	996	0.01	0.01	0.01
CD (*P*=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 3 Influence of method, date of sowing and varieties on economics and energetics of table-purpose groundnut (mean of 2 years)

Treatments	Gross returns* (Rs/ha)	Cost of cultivation (Rs/ha)	Net returns (Rs/ha)	B:C ratio	Output energy (MJ/ha)	Input energy** (MJ/ha)	Energy ratio	Specific energy (MJ/kg)
Method of sowing								
Manual line sowing	68 071	20450	47 621	2.4	3 04 776	12809	23.8	3.6
Manual dibbling	70 879	21750	49 129	2.2	3 20 716	12935	24.8	3.5
SEm±	3 689		3 689	0.2	17 452		1.4	0.2
CD (*P*=0.05)	NS		NS	NS	NS		NS	NS
Time of sowing								
24 December	74 140	21100	53 040	2.5	3 58 139	12872	25.8	3.3
07 January	71 894	21100	50 794	2.4	3 21 149	12872	25.9	3.4
22 January	62 384	21100	41 284	2.0	2 58 951	12872	21.3	3.8
SEm±	2 261		2 261	0.1	13 905		1.1	0.1
CD (*P*=0.05)	6 761		6 671	0.4	NS		3.2	0.4
Varieties								
'SG 99'	68 812	21100	47 712	2.3	3 15 856	12872	24.6	3.6
'ICGS 76'	70 138	21100	49 038	2.4	3 09 637	12872	24.1	3.5
SEm±	1 947		1 947	0.1	11 353		0.9	0.1
CD (*P*=0.05)	NS		NS	NS	NS		NS	NS

*Dry pods : Rs 15/kg in both the years and wet haulm for fodder : Rs 0.25/kg in 2007-08 and Rs 1/kg in 2008-09

*Energy value : dry pods : 25 MJ/kg and green haulm for fodder : 10 MJ/kg

shelling per cent. Manual dibbling recorded significantly higher number of kernels/plant (44.8) and kernel weight (35.6 g/plant). Kernel parameters, viz number of kernels/plant, kernel weight/plant, 100-kernel weight and shelling per cent were significantly influenced by time of sowing. Early sowing registered higher number of kernels/plant (44.8), kernel weight (37.1 g/plant) 100-kernel weight (72.3) and shelling percent (67.3) which was on par with sowing in first week of January. However, delay in sowing beyond 7 January registered significantly lower kernel parameters. 'SG 99' and 'ICGS 76' varieties had no significant difference in kernel parameters. Since both the varieties are having the bold kernels, suitable for table purpose, kernel parameters did not differ much between varieties. Similar findings were earlier reported by Kathirvelan and Kalaiselvan (2007).

Yield

The method of sowing did not influence dry pod yield, haulm yield and harvest index. Time of sowing had significant influence on the pod yield, haulm yield and harvest index (Table 2). Similar to pod and kernel attributes, early sowing (24 December) recorded higher pod yield (3 979 kg/ha) which is at par with 7 January sowing (3 838 kg/ha). Late sowing (22 January) registered significantly lower yield (3 450 kg/ha). Green haulm yield and harvest index also registered similar trend. Higher pod and green haulm yield in early sowing can be attributed to utilization of residual soil moisture by table-purpose groundnut for its germination, pegging and flowering leading to more number of pods/plant, pod weight/plant, kernels/plant and kernel weight which might have determined the pod yield. Residual soil moisture might have been lost during early phase of delayed sowing which could be the cause for lower number of pods/plant, pod weight and kernel weight leading to lower yield. Virender Sardana and Kandhola (2007) also reported late sowing recorded lower yield due to lower crop water-use efficiency in summer groundnut crop. Both the varieties ('SG 99' and 'ICGS 76') recorded almost similar dry pod, green haulm yield and harvest index.

Economics

Economics was calculated based on existing price of dry pod @ Rs 15/kg and green haulm yield for fodder @ 0.25/kg in 2007–08. However considering the cost of green fodder and demand in the islands during dry season, the rate of Rs 1/kg of green haulm was taken for calculation in 2008–09. Many times, the cost of dry pods reaches up to Rs 50/kg in Islands. Cost of cultivation for manual dibbling was more (Rs 21 750/ha) compared to manual line sowing (Rs 20 450/ha) which is due to more time required for sowing under manual dibbling method of sowing (Table 3). Though gross returns and net returns was numerically higher in manual dibbling, B:C ratio was higher in manual line sowing (2.4) compared to manual dibbling (2.2) which is due to higher cost of cultivation under manual dibbling method. Among the time of sowing, though early sowing (24 December) registered significantly higher gross returns (Rs 74 140/ha), net returns (Rs 53 040/ha) and B : C ratio (2.5), it was at par with sowing in first week of January. Late sowing recorded significantly lower net returns and B : C ratio (2.0). Though, the difference in gross returns, net returns and B : C ratio

between 'SG 99' and 'ICGS 76' varieties were non-significant, 'IGCS 76' recorded higher net returns (Rs 49 038/ha) and B:C ratio (2.4) which is at par with 'SG 99". This confirms the finding of Subrahmaniyan *et al.* (2008).

Energetics

Input energy required for manual dibbling was 12 935 MJ/ha compared to manual line sowing (12 809 MJ/ha) because of difference in man-days required for sowing. What was true in terms of pod yield and green haulm yield was also true for output energy as output energy was calculated using the energy value of 25 MJ/kg of pod and 10 MJ/kg of green haulm. Energy ratio was not influenced by either method of sowing or varieties. (Table 3). The amount of energy required to produce 1 kg of pod is called as specific energy was also not significantly influenced by method of sowing and varieties. Early sowing recorded lower specific energy (3.3 MJ/kg) compared to late sowing (3.8 MJ/kg). Energy conversion was much better in early sowing than late sowing mainly due to efficiency of conversion which was expressed through significantly higher pod and green haulm yield. Similar findings in other crops were earlier reported by Ravisankar *et al.* (2007).

Thus, it can be concluded that sowing of table-purpose groundnut can be taken between last week of December to first week of January with 'SG 99' and 'ICGS 76' varieties in manual line sowing method for realizing higher productivity, profitability and energetic under Island conditions. As the labour is constrained in Island, manual dibbling is not advocated.

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