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Yield and profitability of *rabi* groundnut as influenced by sowing windows in South Eastern Ghat Zone of Odisha

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Abstract

Groundnut is one of the most important oilseed crop grown in different parts of India and suitable sowing time is an important determinant for optimum production. So, a field experiment was conducted at Regional Research & Technology Transfer Sub-Station (OUAT), Malkangiri, Odisha during *rabi* season of 2020-21 to 2022-23 to find out suitable date of sowing for groundnut in South Eastern Ghat Zone of Odisha. The experiment was laid out in randomized complete block design with eight different sowing dates (1st, 2nd, 3rd, 4th week of December, 1st, 2nd, 3rd and 4th week of January). Based on pooled analysis, groundnut sown in 1st week of December gave taller plant stature (54.59 cm) followed by crop sown in 2nd week of December (54.57 cm). Same trends were also followed for number of branches plant⁻¹. Significantly highest numbers of pods plant⁻¹ (18.96) was recorded when groundnut sown in 1st week of December followed by 2nd week of December (18.29) and groundnut sown in 4th week of January recorded least value (14.07). Highest number of kernels pod⁻¹ of 2.00 was recorded when groundnut sown in 1st and 2nd week of December. There was no statistical variation observed for 100 kernels weight. However, highest 100 kernels weight (30.05 g) obtained with crop sown in 1st week of December followed by 2nd week of December (30.04 g). Highest pod yield obtained with groundnut sown in 1st week of December (2032 kg ha⁻¹) followed by crop sown in 2nd week of December (2015 kg ha⁻¹). First two dates of sowing was statistically similar for all growth and yield attributes as well as for pod yield of groundnut. Delay in sowing resulted in poor performance for all studied characters. Highest net return (Rs. 53459 ha⁻¹) and B: C ratio (1.90) was obtained when crop sown in 1st week of December followed by 2nd week of December (Net return- Rs. 52471 ha⁻¹; B: C ratio- 1.88) and both have almost similar economic return. So, sowing of groundnut should be done early in 1st to 2nd week of December for obtaining higher yield and economic return in *rabi* season for experimental region.

Keywords: Economics, groundnut, sowing dates, yield

Introduction

Groundnut (*Arachis hypogaea* L.) is a leguminous oilseed crop and its inclusion in cropping system ensures food security as well as environmental, economic and health benefits [1]. Groundnut is a good source of edible oil (43-55%) and protein (25-28%) [2]. Groundnut is one of the most important oilseed crop grown in Odisha and covered an area of 204.82 thousand ha with production and productivity of 387.89 thousand tones and 1894 kg/ha, respectively. *Rabi* season contributes about 66.77% of the total groundnut area in Odisha [3]. South Eastern Ghat Zone of Odisha mainly comprising of Malkangiri district, and it has been considered as a potential region of groundnut. In Malkangiri district, groundnut is cultivated in an area of 15.78 thousand ha with production of 31.17 thousand tones in 2019-20 [3]. The performance of a crop in respect to growth and yield is influenced by various factors but climate stands out as one of most critical determinant [4]. Among the climatic factors, solar radiation, temperature, moisture, humidity and precipitation plays important role in crop production [4,5]. Groundnut is a crop that needs accurate environmental conditions to grow and develop properly, and its reaction to sowing dates might vary depending on the local climate, soil type and other factors. The sowing date is one of the most essential factors that influence growth and yield of a crop.

Optimum sowing time is an important determinant of crop yield because different sowing time provides different environmental conditions within the same location for growth and development of crop. Keeping this in view, the present experiment was framed to assess the yield and profitability of *rabi* groundnut under different sowing dates in South Eastern Ghat Zone of Odisha.

Materials and Methods

The experiment was carried out at the research farm of Regional Research and Technology Transfer Sub-Station (OUAT), Malkangiri, Odisha during *rabi* season of 2020-21 to 2022-23. Initial basic chemical properties of the surface soil (0-15 cm) were pH of 5.5, available nitrogen, phosphorus and potassium as 208.1, 15.8 and 160.7 kg ha⁻¹, respectively. The soil texture of the experimental site was sandy loam. Different weather data during experimentation are shown in Table 1. The experiment

was laid out in randomized complete block design with eight treatments as dates of sowing (1st, 2nd, 3rd, 4th week of December, 1st, 2nd, 3rd and 4th week of January) and each treatment was replicated thrice. Different cultural operations upto the harvest of groundnut (var. Dharani) was followed uniformly as per recommended package of practices to get a healthy crop. Observations on plant height (cm), number of branches plant⁻¹, number of pods plant⁻¹, number of kernels pods⁻¹, 100 kernels weight (g), pod yield (kg ha⁻¹) were recorded at harvest. Economic parameters such as net return and benefit cost ratio were calculated by considering all inputs and outputs as per local situation. The data were statistically analyzed by standard analysis of variance technique for randomized complete block design as suggested by Gomez and Gomez [6], and significant differences between the treatments were compared with the critical difference at $\pm 5\%$ probability level.

Table 1: Monthly weather data during experimentation

Months	Max. Temperature (°C)			Min. Temperature (°C)		
	1 st Year	2 nd Year	3 rd Year	1 st Year	2 nd Year	3 rd Year
December	31.0	29.5	31.8	13.2	15.0	16.8
January	32.3	30.5	31.6	16.2	14.4	15.3
February	33.1	32.8	34.4	16.0	15.4	16.1
March	37.0	37.1	34.7	22.0	21.0	20.4
April	37.2	37.8	36.6	23.7	24.8	23.5
May	36.4	38.0	37.8	25.1	26.0	24.8
Months	Relative humidity % (morning)			Relative humidity % (after noon)		
	1 st Year	2 nd Year	3 rd Year	1 st Year	2 nd Year	3 rd Year
December	92	93	93	37	65	48
January	92	95	93	43	51	43
February	89	91	90	37	53	32
March	82	85	84	42	45	44
April	82	81	81	50	49	45
May	81	75	79	53	46	45
Months	Total Rainfall (mm)			No. of rainy days		
	1 st Year	2 nd Year	3 rd Year	1 st Year	2 nd Year	3 rd Year
December	0	0	0.8	0	0	0
January	0.0	23.9	0	0	1	0
February	25.6	0.0	0	1	0	0
March	0.0	0.9	84.2	0	0	2
April	116.8	67.8	70.8	6	4	3
May	46.0	30.1	26.8	5	3	3

Results and Discussion

Growth attributes

Growth attributes of groundnut viz. plant height and no. of branches plant⁻¹ at harvest were significantly influenced by different dates of sowing during all three years of study (Table 2). The tallest plant stature (55.33 cm) was recorded in groundnut crop sown in 2nd week of December during 1st year and in 1st week of December during 2nd (54.67 cm) and 3rd year (54.97 cm) of experiment. Both 1st and 2nd week of December sown crop are statistically at par for plant height during all three years as well as for pooled analysis. Based on pooled analysis, groundnut sown in 1st week of December gave taller plant stature (54.59 cm) followed by crop sown in 2nd week of

December (54.57 cm). Crop sown in 2nd week of January recorded small plant stature of 50.13 cm. Significantly highest no. of branches plant⁻¹ was observed in the crop sown in 1st week of December (6.33, 6.20 and 6.20) followed by crop sown in 2nd week of December (6.27, 6.07 and 6.00) and lowest with crop sown in 4th week of January (4.93, 4.87 and 4.91). Same trend was also followed for pooled analysis. In respect to years and pooled analysis 1st two dates of sowing was statistically at par for number of branches. These results were supported by the findings of Ashwini *et al.* [5] and Kumar *et al.* [7], who reported significant effect of different sowing dates on growth attributes of groundnut sown on different dates.

Table 2: Effect of different dates of sowing on plant height and no. of branches per plant of groundnut

Treatments	Plant height (cm)				No. of branches plant ⁻¹			
	2020-21	2021-22	2022-23	Pooled	2020-21	2021-22	2022-23	Pooled
1 st week of December	54.13	54.67	54.97	54.59	6.33	6.20	6.20	6.24
2 nd week of December	55.33	54.40	53.97	54.57	6.27	6.07	6.00	6.11
3 rd week of December	50.80	50.07	49.83	50.23	5.80	5.80	5.87	5.82
4 th week of December	50.37	50.07	50.03	50.16	5.67	5.60	5.60	5.62
1 st week of January	50.73	50.47	50.37	50.52	5.47	5.40	5.40	5.42
2 nd week of January	50.03	50.13	50.23	50.13	5.40	5.27	5.20	5.29
3 rd week of January	51.33	50.90	50.73	50.99	5.33	5.13	5.07	5.18
4 th week of January	51.93	50.63	50.00	50.86	4.93	4.87	4.93	4.91
S.Em ($\pm$)	0.94	0.94	1.06	0.77	0.26	0.17	0.20	0.17
CD (5%)	2.86	2.86	3.23	2.33	0.79	0.52	0.60	0.52

Table 3: Effect of different dates of sowing on no. of pods per plant and no. of kernels per pod of groundnut

Treatments	No. of pods plant ⁻¹				No. of kernels pod ⁻¹			
	2020-21	2021-22	2022-23	Pooled	2020-21	2021-22	2022-23	Pooled
1 st week of December	19.07	18.93	18.87	18.96	2.00	2.00	2.00	2.00
2 nd week of December	18.33	18.27	18.27	18.29	2.00	2.00	2.00	2.00
3 rd week of December	17.67	17.87	18.07	17.87	1.97	2.00	2.00	1.99
4 th week of December	16.67	16.40	16.27	16.44	1.93	1.93	1.93	1.93
1 st week of January	15.53	15.33	15.40	15.42	1.93	1.90	1.90	1.91
2 nd week of January	14.87	14.67	14.67	14.73	1.93	1.87	1.87	1.89
3 rd week of January	14.33	14.07	14.13	14.18	1.87	1.87	1.87	1.87
4 th week of January	14.07	14.00	14.13	14.07	1.90	1.87	1.83	1.87
S.Em ($\pm$)	0.53	0.57	0.54	0.40	0.04	0.02	0.02	0.02
CD (5%)	1.60	1.72	1.64	1.20	NS	NS	0.06	0.05

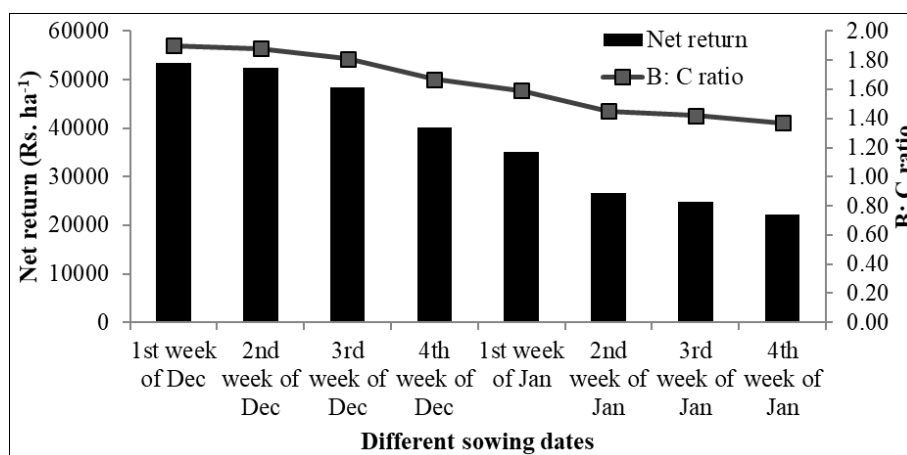
Table 4: Effect of different dates of sowing on 100 kernels weight and pod yield of groundnut

Treatments	100 kernels weight (g)				Pod yield (kg ha ⁻¹)			
	2020-21	2021-22	2022-23	Pooled	2020-21	2021-22	2022-23	Pooled
1 st week of December	30.12	30.06	29.97	30.05	2046	2036	2015	2032
2 nd week of December	30.11	30.02	29.98	30.04	2026	2029	1989	2015
3 rd week of December	29.70	30.02	30.19	29.97	1932	1937	1952	1940
4 th week of December	30.02	29.97	29.94	29.98	1807	1780	1788	1792
1 st week of January	30.77	29.96	29.55	30.09	1736	1708	1664	1703
2 nd week of January	29.88	29.68	29.58	29.72	1563	1547	1543	1551
3 rd week of January	29.42	29.19	29.07	29.23	1528	1515	1507	1517
4 th week of January	29.00	29.12	29.18	29.10	1502	1472	1435	1470
S.Em ($\pm$)	0.37	0.34	0.50	0.32	61.8	39.3	77.2	40.3
CD (5%)	NS	NS	NS	NS	187.5	119.2	234.1	122.2

Yield attributes and yield

Among the yield attributes, number of pods plant⁻¹ was significantly varied by different dates of sowing (Table 3). Number of pods plant⁻¹ was found to vary between 14.07 – 19.07 during 1st year, 14.00 – 18.93 during 2nd year and 14.13 – 18.87 during 3rd year of experiment. Based on pooled analysis, significantly highest numbers of pods plant⁻¹ (18.96) was recorded when groundnut sown in 1st week of December followed by 2nd week of December (18.29) and groundnut sown in 4th week of January recorded least value (14.07). Same trends were also followed for number of kernels pod⁻¹ (Table 3) and highest number of kernels pod⁻¹ of 2.00 was recorded when groundnut sown in 1st and 2nd week of December followed by 3rd week of December (1.99). First two date of sowing was statistically at par for number of pods plant⁻¹ and number of kernels pod⁻¹. In case of 100 kernels weight there was no statistical variation observed in respect to years and pooled analysis (Table 4). However, highest 100 kernels weight (30.05

g) obtained with crop sown in 1st week of December followed by 2nd week of December (30.04 g) and groundnut sown in 4th week of January recorded least value (29.10 g). Irrespective of years and pooled analysis, pod yield of groundnut was significantly influenced by different dates of sowing (Table 4). Highest pod yield of 2046, 2036 and 2015 kg ha⁻¹ obtained when sown in 1st week of December followed by 2026, 2029 and 1989 kg ha⁻¹ when sown in 2nd week of December during 1st, 2nd and 3rd year, respectively. Based on pooled analysis, significantly highest pod yield obtained with groundnut sown in 1st week of December (2032 kg ha⁻¹) followed by crop sown in 2nd week of December (2015 kg ha⁻¹). Groundnut sown on 4th week of January recorded lowest pod yield (1470 kg ha⁻¹). First two date of sowing was statistically at par for pod yield of groundnut. The increased pod yield was due to higher growth and yield attributing characters obtained with first two dates of sowing. Superior growth and yield attributing characters responsible for higher pod yield of groundnut was also reported in some others study [5,8,9].

**Fig. 1:** Effect of different dates of sowing on net return and benefit cost ratio of groundnut (mean data of three years)

Economics

Based on mean data of three years, among the different sowing dates of groundnut highest net return (Rs. 53459 ha⁻¹) and B: C ratio (1.90) was obtained when crop sown in 1st week of December followed by 2nd week of December (Net return- Rs. 52471 ha⁻¹; B: C ratio- 1.88) and groundnut sown in 4th week of January recorded least economic return (Net return- Rs. 22150 ha⁻¹; B: C ratio- 1.37). Groundnut in first two dates of sowing showed almost similar economic return (Fig. 1). Higher net returns and B:C ratio might be due to higher productivity.

Conclusion

The present study revealed that sowing of *rabi* groundnut should be done early in 1st week of December to 2nd week of December for obtaining high yield and economic return in the experimental region.

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