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RESEARCH PAPER

Effect of sowing windows and varieties on growth, yield and oil content of groundnut (*Arachis hypogaea* L.) during *rabi* season in Northern Transition Zone of Karnataka

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Abstract: A field experiment was conducted on to assess the productivity of groundnut varieties under different sowing windows during *rabi* season in Northern Transition Zone of Karnataka" at MARS, Dharwad during 2020-21. The experiment was laid out in strip- plot design with three replications consisting of three sowing windows as vertical factor and four varieties as horizontal factor . Groundnut sown on 48th MW recorded significantly higher pod yield (2805 kg ha^{-1}) and at par with 52nd MW. The pod yield was increased to the tune of 19.51 per cent during 48th MW and 18.19 per cent during 52nd MW over the 42nd MW. The variety Dh-257 recorded significantly higher pod yield (3240 kg ha^{-1}) and was at par with Dh-256. The variety Dh-257 and Dh-256 recorded 83.56 and 83.39 per cent increased pod yield respectively, over TMV-2. The variety Dh-257 sown on 48th MW recorded significantly higher pod yield (3442 kg ha^{-1}) and on par with Dh-257 sown on 52nd MW, Dh-256 sown on 48th MW and 52nd MW. The variety Dh-257 sown on 48th MW and 52nd MW recorded 126.00 and 125.80 per cent higher pod yield compared to TMV-2 sown on 42nd MW respectively. Groundnut sown on 48th MW recorded significantly higher net returns (₹ 105139 ha^{-1}) and at par with 52nd MW compared to 42nd MW. The variety Dh-257 recorded significantly higher net returns (₹ 131489 ha^{-1}) and at par with Dh-256 compared to K-1574 and TMV-2. The variety Dh-257 sown on 48th MW recorded significantly higher net returns (₹ 143423 ha^{-1}) and on par with Dh-257 sown on 52nd MW, Dh-256 sown on 48th MW and 52nd MW.

Key words: Groundnut, Growing degree days, Quality, Sowing windows

Introduction

The groundnut is cultivated on large scale in almost all the tropical and sub-tropical countries. In India, the crop is cultivated in an area of 4.82 m ha with a total production of 9.95 m t with productivity of 2063 kg ha^{-1}. In Karnataka, the crop is cultivated in an area of 5.02 lakh ha with a total production of 4.23 lakh t with a productivity of 1069 kg ha^{-1} (Anon., 2020).

Groundnut during *rabi* season is gaining significant importance in some parts of Northern Karnataka. At present in Ramdurga (Belgaum) and Badami (Bagalkot) taluks farmers are practicing groundnut cultivation in about 2000 ha of area during *rabi* season. Hence, the selection of suitable genotypes and sowing window the important non-monetary inputs that play a significant role in enhancing the productivity of the crop during *rabi* season. The groundnut genotypes are much sensitive and influenced by weather parameters like solar radiation, temperature, moisture, humidity and precipitation. Hence, selection of suitable genotypes for appropriate sowing window assumes greater significance for higher and sustained production, efficient utilization and conservation of resources. Taking these facts into consideration an experiment was undertaken to assess the productivity and oil content of groundnut varieties under different sowing windows during *rabi* season in Northern Transition Zone of Karnataka.

Material and methods

The experiment was conducted during *rabi* season 2020-21 on medium black clay loam soil at AICRP on Groundnut, MARS, University of Agricultural Sciences, Dharwad which is located at 15°29' N latitude and 74°59' E longitude. The experiment was laid out in strip- plot design with three replications consisting of three sowing windows as vertical factor D_1: 42nd MW (15 October- 21 October), D_2: 48th MW (26 November- 02 December), D_3: 52nd MW (24 December- 31 December) and four varieties as horizontal factor V_1: Dh-256, V_2: Dh-257, V_3: K-1574, V_4: TMV-2. Treated seeds were sown manually at a spacing of 30×10 cm. Gap filling was done at 8 days after sowing of groundnut. Farm yard manure @ 7.5 t ha^{-1} was applied 15 days before sowing. Basal application of nitrogen @ 18 kg N ha^{-1} and phosphorus @ 46 kg P_2O_5 ha^{-1} were applied in form of diammonium phosphate and potassium @ 25 kg K_2O ha^{-1} in the form of muriate of potash. $FeSO_4$ and $ZnSO_4$ @ 25 kg ha^{-1} were also applied at time sowing. Gypsum was applied @ 500 kg ha^{-1} at peg initiation stage. The crop was provided with total irrigation of 450 mm at 15 days interval including pre-sowing and uprooting irrigation. According to the date of sowing and duration of the varieties, the crop was harvested at physiological maturity. Growth and yield observations at harvest and oil content, oil yield and economics were recorded as per the standard procedures. The data collected from the experiment during crop growth period were subjected to statistical analysis as described by Gomez and Gomez (1984).

Results and discussion

Effect of sowing windows on growth and yield of groundnut

The pod and haulm yield of groundnut was significantly influenced by sowing windows. Groundnut sown on 48th MW recorded significantly higher pod yield and haulm yield (2805 kg ha^{-1} and 3027 kg ha^{-1}, respectively) and found at par

Table 1. Growth parameters of groundnut at harvest as influenced by different sowing windows and varieties

Treatments	Plant height (cm)	No. of branches plant^{-1}	Leaf area (dm^2 plant^{-1})	Leaf area index
Sowing window				
D_1	25.38	7.78	8.82	2.94
D_2	28.65	8.02	10.58	3.53
D_3	28.39	8.01	10.54	3.51
S.Em. ±	0.11	0.006	0.01	0.004
C.D. (p=0.05)	0.42	0.023	0.05	0.017
Variety				
V_1	25.17	7.97	10.38	3.46
V_2	28.61	7.92	10.40	3.47
V_3	29.12	8.00	9.74	3.25
V_4	26.99	7.86	9.41	3.14
S.Em. ±	0.16	0.007	0.03	0.011
C.D. (p=0.05)	0.55	0.024	0.12	0.039
Interaction (D×V)				
D_1V_1	22.02	7.84	9.11	3.04
D_1V_2	26.83	7.75	8.94	2.98
D_1V_3	27.70	7.88	8.74	2.91
D_1V_4	24.97	7.65	8.49	2.83
D_2V_1	27.00	8.04	11.02	3.67
D_2V_2	29.53	8.01	11.14	3.71
D_2V_3	30.03	8.06	10.27	3.42
D_2V_4	28.03	7.96	9.89	3.30
D_3V_1	26.50	8.04	10.99	3.66
D_3V_2	29.47	8.00	11.10	3.70
D_3V_3	29.63	8.05	10.21	3.40
D_3V_4	27.97	7.95	9.85	3.28
S.Em. ±	0.26	0.010	0.05	0.018
C.D. (p=0.05)	0.79	0.031	0.16	0.054

Sowing windows (D) D_1: 42nd MW (15 October- 21 October)
D_2: 48th MW (26 November- 02 December)
D_3: 52nd MW (24 December- 31 December)
Varieties (V)
V_1: Dh-256
V_2: Dh-257
V_3: K-1574
V_4: TMV-2
NS: Non significant DAS: Days after sowing

with groundnut sown on 52nd MW (2774 kg ha^{-1} and 3000 kg ha^{-1}, respectively). Groundnut sown during 48th MW recorded 19.51 per cent higher pod yield and 18.19 per cent during 52nd MW over the 42nd MW (Table 3). The increased pod yield and haulm yield was due to higher yield attributing characters *viz.*, number of pods plant^{-1} (Table 2), pod weight plant^{-1}, 100 kernel weight (Table 3), shelling percentage and harvest index (Table 3). Increase in the pod yield and yield attributes was mainly due to higher plant height, number of branches, leaf area plant^{-1} and leaf area index (Table 1). Hussain *et al*. (2019) attributed significantly higher pod yield to the higher yield attributing characters and favourable weather condition. Similar results were also reported by Ibraheem *et al*. (2018), Ijaz *et al*. (2021) and Kumar *et al*. (2017) in groundnut.

Effect of varieties on growth and yield of groundnut

The variety Dh-257 recorded significantly higher pod yield (3240 kg ha^{-1}) and haulm yield (3480 kg ha^{-1}) and found at par with Dh-256. The increase in pod yield of the varieties was attributed to genetic makeup resulted in better performance of yield to an extent of 83.56 per cent in Dh-257 and 83.39 per cent in Dh-256 compared to the variety TMV-2. The increased pod yield and haulm yield of the varieties was due to higher yield attributing characters *viz.*, number of pods plant^{-1} (Table 2), shelling percentage, harvest index (Table 3). Raagavalli *et al*. (2019) attributed significantly higher pod yield to the better morpho- physiological characters of the varieties. Similar results were also reported by Chaudhari *et al*. (2018) and Kumar *et al.* (2020) in groundnut.

Table 2. Pod and kernel yield of groundnut as influenced by different sowing windows and varieties

Treatments	Pod weight (g plant^{-1})	Pod yield (kg ha^{-1})	Kernel yield (kg ha^{-1})	100 kernel weight (g)
Sowing window				
D_1	17.36	2347	1445	42.26
D_2	26.68	2805	1888	48.29
D_3	26.34	2774	1862	47.62
S.Em. ±	0.18	19.25	13.93	0.21
C.D. (p=0.05)	0.71	75.57	54.71	0.83
Variety				
V_1	25.83	3237	2134	45.89
V_2	25.84	3240	2135	45.92
V_3	21.88	2327	1531	55.82
V_4	20.28	1765	1126	36.59
S.Em. ±	0.30	19.02	8.27	0.41
C.D. (p=0.05)	1.04	65.82	28.61	1.43
Interaction (D×V)				
D_1V_1	19.63	2925	1838	42.97
D_1V_2	18.61	2840	1764	40.43
D_1V_3	16.23	2100	1275	51.40
D_1V_4	14.97	1523	903	34.23
D_2V_1	28.95	3393	2282	47.50
D_2V_2	29.71	3442	2322	48.77
D_2V_3	25.02	2471	1686	58.50
D_2V_4	23.03	1916	1263	38.40
D_3V_1	28.90	3392	2281	47.20
D_3V_2	29.21	3440	2320	48.57
D_3V_3	24.39	2410	1633	57.57
D_3V_4	22.85	1855	1213	37.13
S.Em. ±	0.28	26.45	21.97	0.60
C.D. (p=0.05)	0.86	81.50	67.69	1.85

Sowing windows (D) D_1: 42nd MW (15 October- 21 October)
D_2: 48th MW (26 November- 02 December)
D_3: 52nd MW (24 December- 31 December)
Varieties (V)
V_1: Dh-256
V_2: Dh-257
V_3: K-1574
V_4: TMV-2
NS: Non significant DAS: Days after sowing

Table 3. Yield parameters and oil content of groundnut as influenced by different sowing windows and varieties

Treatments	Shelling percentage (%)	Haulm yield (kg ha^{-1})	Harvest index	Oil content (%)
Sowing window				
D_1	61.43	2519	29.46	41.16
D_2	69.25	3027	32.45	42.08
D_3	68.74	3000	32.18	41.77
S.Em. ±	0.23	21.75	0.23	0.22
C.D. (p=0.05)	0.92	85.40	0.90	NS
Variety				
V_1	68.44	3472	31.80	42.95
V_2	68.53	3480	31.72	43.17
V_3	65.40	2563	31.20	37.86
V_4	63.53	1880	30.74	42.70
S.Em. ±	0.20	17.02	0.15	0.18
C.D. (p=0.05)	0.70	58.88	0.54	0.61
Interaction (D×V)				
D_1V_1	63.63	3023	31.29	42.09
D_1V_2	62.10	2853	30.98	42.68
D_1V_3	60.70	2432	28.13	37.40
D_1V_4	59.30	1767	27.45	42.49
D_2V_1	70.96	3701	32.17	43.79
D_2V_2	71.92	3815	32.01	43.44
D_2V_3	68.23	2646	32.94	38.23
D_2V_4	65.90	1948	32.68	42.86
D_3V_1	70.72	3691	31.93	42.95
D_3V_2	71.56	3772	32.17	43.41
D_3V_3	67.27	2610	32.53	37.95
D_3V_4	65.40	1925	32.10	42.76
S.Em. ±	0.42	47.31	0.40	0.17
C.D. (p=0.05)	1.29	145.78	1.22	NS

Sowing windows (D) D_1: 42nd MW (15 October- 21 October)
D_2: 48th MW (26 November- 02 December)
D_3: 52nd MW (24 December- 31 December)
Varieties (V) V_1: Dh-256
V_2: Dh-257
V_3: K-1574
V_4: TMV-2
NS: Non significant DAS: Days after sowing

Interaction effect of sowing windows and varieties on growth and yield of groundnut

The variety Dh-257 sown during 48th MW recorded significantly higher pod yield (3442 kg ha^{-1}) and found on par with Dh-257 sown during 52nd MW (3440 kg ha^{-1}), Dh-256 sown during 48th MW (3393 kg ha^{-1}) and 52nd MW (3392 kg ha^{-1}). The variety Dh-257 sown during 48th MW and 52nd MW recorded 126.00 and 125.80 per cent, respectively and the variety Dh-256 sown during 48th MW and 52nd MW recorded 122.78 and 122.71 per cent, respectively compared to TMV-2 sown during 42nd MW. The increased pod yield and haulm yield was due to higher growth and yield attributing characters *viz.*, number of pods plant^{-1} , pod weight plant^{-1} and 100 kernel weight (Table 2), shelling percentage, harvest index (Table 3), might be due to genetic potentiality of improved varieties coupled with favourable weather conditions prevailed during 48th MW. The findings were in conformity with the results of Hussain *et al*. (2019) who attributed significantly higher pod yield to the higher yield attributing characters and favourable weather condition. Similar results were also reported by Ibraheem *et al*. (2018), Ijaz *et al*. (2021) and Kumar *et al*. (2017) in groundnut.

Effect of sowing windows on oil content of groundnut varieties

Significantly higher oil content (43.17 %) was recorded in the variety Dh-257 and found on par with Dh-256 (42.95 %) and TMV-2 (42.70 %) compared to the variety K-1574 (37.86 %). Groundnut sown on 48th MW recorded significantly higher oil yield (798.27 kg ha^{-1}) and found at par with groundnut sown on 52nd MW (781.37 kg ha^{-1}) compared to groundnut sown on 42nd MW (596.70 kg ha^{-1}). The variety Dh-257 recorded significantly higher oil yield (922.78 kg ha^{-1}) and found at par with Dh-256 (917.53 kg ha^{-1}) compared to the variety TMV-2 (481.18 kg ha^{-1}) (Table 3 and 4). Interaction effect of sowing windows and

Table 4. Oil yield and economics of groundnut as influenced by different sowing windows and varieties

Treatments	Oil yield (kg ha^{-1})	Gross returns (₹ ha^{-1})	Net returns (₹ ha^{-1})	B:C ratio
Sowing window				
D_1	596.70	142069	77374	2.19
D_2	798.27	169834	105139	2.62
D_3	781.37	167945	103250	2.59
S.Em. ±	4.26	1151	1151	0.02
C.D. (p=0.05)	16.74	4519	4519	0.07
Variety				
V_1	917.53	195929	131489	3.04
V_2	922.78	196167	131183	3.02
V_3	580.30	140888	73592	2.09
V_4	481.18	106813	44753	1.72
S.Em. ±	3.57	1142	1142	0.02
C.D. (p=0.05)	12.35	3951	3951	0.06
Interaction (D×V)				
D_1V_1	773.57	177012	112572	2.75
D_1V_2	752.71	171827	106843	2.64
D_1V_3	476.93	127196	59900	1.89
D_1V_4	383.60	92243	30183	1.49
D_2V_1	999.25	205430	140990	3.19
D_2V_2	1008.43	208407	143423	3.21
D_2V_3	644.22	149563	82267	2.22
D_2V_4	541.18	115934	53874	1.87
D_3V_1	979.77	205346	140906	3.19
D_3V_2	1007.21	208266	143282	3.20
D_3V_3	619.76	145905	78609	2.17
D_3V_4	518.76	112262	50202	1.81
S.Em. ±	9.96	1584	1584	0.02
C.D. (p=0.05)	30.69	4882	4882	0.08

Sowing windows (D) D_1: 42nd MW (15 October- 21 October)
D_2: 48th MW (26 November- 02 December)
D_3: 52nd MW (24 December- 31 December)
Varieties (V) V_1: Dh-256
V_2: Dh-257
V_3: K-1574
V_4: TMV-2
NS: Non significant DAS: Days after sowing

varieties showed significant difference in oil yield. The variety Dh-257 sown on 48th MW recorded significantly higher oil yield (1008.43 kg ha^{-1}) and found on par with Dh-257 sown on 52nd MW (1007.21 kg ha^{-1}), Dh-256 sown on 48th MW (999.25 kg ha^{-1}) and 52nd MW (979.77 kg ha^{-1}) compared to TMV-2 sown on 42nd MW (383.60 kg ha^{-1}). The findings are in conformity with the results of Mohite *et al*. (2017) attributed to higher kernel yield and oil content.

Effect of sowing windows and varieties on economics of groundnut

Significantly higher net returns was recorded with the variety Dh-257 sown on 48th MW (₹ 143423 ha^{-1}) and found on par with Dh-257 sown on 52nd MW (₹ 143282 ha^{-1}), Dh-256 sown on 48th MW (₹ 143282 ha^{-1}) and 52nd MW (₹ 140906 ha^{-1}). The higher net returns was due to higher pod yield and haulm yield (Table 4). These results were in conformity with the findings of Ibraheem *et al*. (2018), Ijaz *et al*. (2021) and Kumar *et al*. (2017) in groundnut. The variety Dh-257 sown on 48th MW recorded significantly higher B-C ratio (3.21) and found on par with Dh-257 sown on 52nd MW (3.20), Dh-256 sown on 48th MW (3.19) and 52nd MW (3.19) which was attributed to the higher pod yield and higher net returns.

Conclusion

It was concluded that sowing of groundnut variety Dh-257 during 48th MW found optimum for higher pod yield, oil content, oil yield and net returns which was on par with Dh-257 sown on 52nd MW and Dh-256 sown on 48th MW during *rabi* season in Northern Transition Zone of Karnataka.

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