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Response of groundnut (*Arachis hypogaea* L.) cultivars to sowing dates under summer season

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Abstract
A field experiment entitled "Response of Groundnut (*Arachis hypogaea* L.) Cultivars to Sowing Dates under Summer Season" was undertaken during summer season, 2022 at AICRP on Groundnut, Cotton Improvement Project, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (M.S.). The experiment consist of twelve treatments with three replications in split plot design. There were the main plot treatments consist of sowing dates *viz.,* D_1- 30th December (52nd MW), D_2- 2nd MW (15th January), D_3 -4th MW (30th January) and D_4- 6th MW (15th February) and sub-plot treatments includes three cultivars *viz.,* C_1-Phule Unnati, C_2-Phule-6021 and C_3-KDG-160. In present study, the results stated that the sowing on 30th January (4th MW) recorded maximum growth parameters also significantly higher growth and yield attributes *viz.,* plant height, number of branches plant^{-1}, dry matter production, total number of pods, weight of kernels, dry pod yield (28.45 q ha^{-1}), kernel yield (19.65 q ha^{-1}) and creeper yield (37.92 q ha^{-1}). However, the cultivar Phule Unnati recorded significantly maximum growth and yield attributes *viz.,* plant height, dry matter production plant^{-1} (g), total number of pods, weight of kernels, dry pod yield (28.67 q ha^{-1}) kernel yield (19.78 q ha^{-1}) and creeper yield (35.20 q ha^{-1} recorded significantly higher with sowing on 30th January (4th MW) followed by 15th February (6th MW). On the basis of economic studies, sowing of summer groundnut on 30th January (4th MW) and cultivar Phule Unnati was established most lucrative to obtain higher net monetary returns (93559 ₹ ha^{-1} and 93118 ₹ ha^{-1}) and B: C ratio (2.92 and 2.85), respectively. On the basis of one year experiment, it could be come to an end that the summer groundnut Phule Unnati sown in 30th January (4th MW) found beneficial in respect of plant growth, yield and economic returns.

Keywords: Groundnut, sowing windows, cultivars, yield and yield attributes

Introduction
Groundnut is a principal oilseed crop. It be allied to family Fabaceae (*Leguminosae*) and genus Arachis with species hypogaea. The word *Arachis hypogaea* has been derived from Greek word, Arachis meaning legume, hypogaea meaning below ground. Groundnut is also called as peanut, earthnut, monkey nut, manila nut, goober and panda. Besides being a key source of vegetable oil, it is also used as an important source of food, feed, nutrition and fodder. Groundnut kernels have about 25% protein which is about 1.3 times higher than meat, 2.5 times higher than eggs and 8 times higher than fruits. The oil content of kernels sweep from 40- 52% and is extensively used for cooking purpose. Oil is rich source of vitamin A, B and E. Groundnut kernels are used in roaste form for culinary purposes. Groundnut is also rated as rotation crop. Exist a legume with root nodules, it can fix atmospheric nitrogen and thereby improves soil fertility. It ranks first among the oilseed crops in India contributing 33% of the world's production and 40% of area. Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka and Maharashtra are the major groundnut producing states in India contributing more than 80% of total groundnut production. The cultivation of groundnut can be superior under well irrigation in the course of summer. Sowing rhythm is also important as temperature is the main element deciding successful production of crop during summer.

Material and Method
A field investigation was conducted on groundnut throught the time of summer season, 2022 at AICRP on Groundnut, Cotton Improvement Project, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (M.S.). Rahuri which is situated between 19° 47' and 19° 57' North latitude and 74° 32' and 74° 19' East longitude. The altitude is 525 meter above mean sea level.

It is palced about 525 m above mean sea level. This tract lying on the eastern side of Western Ghats, falls under rain shadow area with an annual rainfall range from 307 to 619 with average of 520 mm. the mean maximum temperature recorded through crop growth period ranged in between 27.9 °C to 36.6 °C and minimum temperature recorded in the time of crop growth period ranged in between 9.2 °C to 23 °C. The relative humidity during the morning and evening ranged in between 78 to 93.2% and 26.7 to 81.4%, respectively. The total rainfall received during the period of experimentation was 222.0 mm during 52nd, 2th and 4th to 6th meteorological week. Mean evaporation recorded was amid 3.0 to 11.5 mm per day. The mean wind velocity recorded during the period of experimentation was in between 0.4 to 5.9 km^{-1}. The sunshine hours ranged from 2.90 to 9.8 hours day^{-1}. There was 6 rainy days during investigation. The total rainfall encountered during experimentation spell was 222.0 mm.

The experiment was conducted on sandy clay loam soil which was low in accessible nitrogen (180.30 kg ha^{-1}), medium in obtainable phosphorus (17.20 kg ha^{-1}) and very high in available potassium (328.29 kg ha^{-1}). The experiment composed of twelve treatments with three replications in split plot design. There were the main plot treatments contain of sowing dates *viz.*, D_1- 30th December (52nd MW), D_2- 15th January (2nd MW), D_3 -30th January (4th MW) and D_4- 15th February (6th MW) and sub-plot treatments includes three cultivars *viz.*, C_1-Phule Unnati, C_2-Phule-6021 and C_3-KDG-160. The recommended dose of fertilizer *viz.*, 25:50:00:25 $N:P_2O_5:K_2O:SO_4^{-2}$. The gross and net plot size were 4.5 m x 3.0 m and 4.1 m x 2.40 m, respectively. The groundnut cultivars dibbled at 30 cm x10 cm. The biometric observations of groundnut, from each net plot, five plants were selected at random and tagged. From each plant, observations on various morphological and growth parameters were taken down at 30, 60, 90 DAS and at harvest. Observations on growth and yield parameters *viz*., plant height, number of branches $plant^{-1}$, dry matter production, number of pod $plant^{-1}$, weight of dry pod per plant, weight of kernels per plant, dry pod yield, kernel yield and creeper yield.

Results and Discussion

Growth character

Effect of sowing dates

An appraisal of the data presented in Table 1 revealed that the plant height, The number of branches $plant^{-1}$ and dry matter $plant^{-1}$ was significant due to dates of sowing at harvest. Significantly higher plant height was recorded under 30th January (4th MW) (30.65 cm) followed by 15th February (6th MW) than rest of sowing. The taller and larger plants height under 30th January (4th MW) may be due to favorable climatic condition (temperature, relative humidity and bright sunshine hours etc.) for growth, especially optimum temperature in early growth stages available to the crop. Whereas, in case of 30th December the low temperature during the early stages resulted in significantly lower plant height. These detection are in accordance with those reported by Kumar *et al*. (2017) [3].

The number of branches at harvest was highest in sowing of 30th January (4th MW) (11.65) followed by 15th February (6th MW) than rest of sowing. These might be due better favorable climatic condition (sunshine hours, temperature). This findings are in accordance with Jangilwad *et al*. (2018) [1]. Significantly higher dry matter $plant^{-1}$ was recorded under 30th January (4th MW) (37.90 g) followed by 15th February (6th MW). The highest dry matter $plant^{-1}$ under 30th January (4th MW) may be due to favorable climatic condition (temperature, relative humidity and bright sunshine hours etc.) for growth, especially optimum temperature in early growth stages available to the crop. Whereas, in case of 30th December (52nd MW). The low temperature during the early stages resulted in significantly lower leaves and leaf area due low interception of light. These both finding are in accordance with those announced by Shendage *et al*. (2018) [4].

Effect of cultivars

The plant height at harvest (30.58 cm) was significantly higher under Phule Unnati followed by Phule-6021 and KDG-160. These discovery are in relation with those reported by Swami (2020) [8]. They reported the highest plant height at the time of harvest was under Phule Unnati than rest of cultivars. The number of branches at harvest (11.10 cm) was significantly higher under Phule Unnati followed by Phule-6021 and KDG-160. These finding are in accordance with those reported by Swami (2020) [8]. They reported the highest branches at the time of harvest was under Phule Unnati than rest of cultivars. The dry matter $plant^{-1}$ at harvest (37.16 g) was significantly higher under Phule Unnati followed by Phule-6021 and KDG-160. These both finding are in bestowal with those reported by Wankhede *et al.* (2018) [7]. They reported the highest branches at the time of harvest was under Phule Unnati than rest of cultivars

Interaction effect

The interaction effect of between sowing dates and cultivars accomplished to be non-significant with respect to plant height, number of branches and dry matter $plant^{-1}$ respectively.

Yield characters

Effect of sowing dates

An appraisal of the data presented in Table 1 revealed that the number of pod $plant^{-1}$ (35.11) was observed significantly higher in 30th January (4th MW) sowing than other sowing dates, the dry pod weight $plant^{-1}$ (28.66 g) and kernel weight $plant^{-1}$ (19.79) were recorded significantly higher in 30th January (4th MW) sowing followed by 15th February (6th MW) than rest sowing dates. The probable reason for higher dry pods weight and kernel weight may be ascribed due to transfer of photosynthates in direction of sink there after reduced weight on 15th February (6th MW) due to shorter period available for development of new pods. These outcome are collaborated with those reported by More and Khade (1987) [2] and Shendage *et al.* (2018) [4]. The shelling percentage were recorded non- significantly higher (68.97%) in 30th January (4th MW) sowing than rest of sowing.

The dry pod yield (28.45 q ha^{-1}) and creeper yield (37.92 q ha^{-1}) was recorded significantly higher in 30th (4th MW) January sowing followed by 15th February (6th MW) than rest of sowing. The lowest dry pod yield (26.02 q $ha^{-1)}$ and creeper yield (32.96 q ha^{-1}) was observed in 30th December (52nd MW) of sowing. A sowing date of 30th January (4th MW) was favorable to maximum pod production and creepers because of favorable weather condition. In respect of kernel yield (19.65 q ha^{-1}) which was significantly higher in 30th January (4th MW) sowing than others. These result are collaborated with Patra *et al.* (1998) [5] and Shendage *et al.* (2018) [4].

Table 1: Mean plant height plnat^{-1} (cm), number of branches plant^{-1}, dry matter plant^{-1} (g) as influenced by different treatment at harvest

Treatments	Plant height (cm)	No. of branches	Dry matter Plant^{1}(g)
A. Main plot treatment: Sowing dates			
D_1= 30th December (52nd MW)	27.27	9.17	32.45
D_2= 15th January (2nd MW)	28.64	9.96	35.05
D_3 = 30th January (4th MW)	30.65	11.65	37.90
D_4 = 15th February (6th MW)	29.95	11.26	35.35
S.Em ±	0.34	0.08	0.42
C.D. at 5%	1.20	0.30	1.46
B. Sub plot treatment: Cultivars			
C_1= Phule Unnati	30.58	11.10	62.51
C_2 = Phule - 6021	28.93	10.48	61.23
C_3 = KDG-160	27.70	9.95	60.00
S.Em ±	0.30	0.17	0.49
C.D. at 5%	0.92	0.53	1.49
Interaction (A x B)			
S.Em ±	0.61	0.35	0.99
C.D. at 5%	NS	NS	NS
General mean	29.07	10.51	35.36

Effect of cultivars

The number of pod plant^{-1} was (34.00) observed significantly higher in Phlue unnati than Phule-6021 and KDG-160. The weight of pod plant^{-1} (26.15 g) and kernel weight plant^{-1} (18.10 g) were significantly higher in cultivars Phule Unnati which was higher than other cultivars under comparison. Thise results are in conformation with Wankhede *et al.* (2018) [7] also shelling percentage was higher in Phule Unnati and at par with Phule -6021.

The dry pod yield (28.68 q ha^{-1}) and creeper yield (38.33 q ha^{-1}) was recorded significantly higher in Phule Unnati cultivars followed by cultivar Phule-6021. The lowest dry pod yield (25.74 q ha^{-1}) and creeper yeild (38.33 q ha^{-1}) were observed in KDG-160 cultivars. The differences in dry pod yield and creeper yield of groundnut cultivars might be due to inherent genetic potential. This results are similar with Wankhede *et al.* (2018) [7]. In respect of kernel yield (19.78 q ha^{-1}) which was higher in Phule Unnati followed by Phule -6021 and KDG-160.

Interaction effect

The interaction effect were found non-significant in all the yield character except in kernel yield. The sowing on 4th MW (30th January) with cultivars Phule Unnati produced significantly higher kernel yield (22.03 q ha^{-1}).

Economics

Economics was studied based on market price of dry pod @ 5000.00 INR/q in the year 2022, respectively. The net returns and B: C ratios were numerically higher on 4th MW (30th January) sowing (93559 /ha and 2.92) and in cultivar 'Phule Unnati' it was (93118 /ha and 2.85) separately. Minimum net returns and B: C ratio were observed in 52nd MW (30th December) of sowing (78291 /ha and 2.51) and in cultivars KDG-160 it was (78485 /ha and 2.56) respectively. This confirms the finding of Ravisankar *et al.* (2010) [6].

Table 2: Mean total number of pod plant^{-1}, dry pod weight plant^{-1}, kernel weight plant^{-1}, shelling percent, dry pod yield (q ha-1) kernel yield (q ha^{-1}) creeper yield (q ha$^{-1)}$

Treatments	Total no of Pods	Dry pod weight plant^{-1} (g)	Kernel weight plant^{-1} (g)	Shelling percent (%)	Dry pod yield (q ha^{-1})	Kernel yield (q ha^{-1})	Creeper yield (q ha^{-1})
A. Main plot treatment: Sowing Dates							
D_1=52nd MW (30th December)	27.66	22.01	14.38	65.31	26.02	17.01	32.96
D_2= 15th January (2nd MW)	31.22	23.34	15.63	66.83	27.01	18.05	34.15
D_3 = 4th MW (30th January)	35.11	28.66	19.79	68.97	28.45	19.65	37.92
D_4 = 6th MW (15th February)	32.78	26.72	18.16	68.13	27.15	18.47	35.78
S.Em ±	0.54	0.28	0.31	0.95	0.36	0.23	0.51
C.D. at 5%	1.89	0.99	1.08	NS	1.26	0.81	1.54
B. Sub plot treatment: Cultivars							
C_1= Phule Unnati	34.00	26.15	18.10	69.08	28.68	19.78	38.33
C_2 = Phule -6021	31.58	25.51	17.22	67.40	27.06	18.24	35.17
C_3 = KDG-160	29.50	23.88	15.66	65.45	24.74	16.86	32.10
S.Em ±	0.74	0.20	0.27	0.73	0.34	0.13	0.49
C.D. at 5%	2.22	0.60	0.83	2.21	1.02	0.41	1.47
Interaction (A x B)							
S.Em ±	1.48	0.40	055	1.47	0.68	0.27	0.98
C.D. at 5%	NS	NS	NS	NS	NS	0.82	NS
General mean	31.69	25.18	16.99	67.44	27.16	18.30	35.20

Conclusion

On the basis of one year result of experiment, it could be concluded that the summer groundnut cultivar Phule Unnati sown in 30th January (4th MW) found beneficial in respect of plant growth, yield and economic returns.

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