Biological Forum – An International Journal **15(8a): 51-57(2023)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Effect of Dates of Sowing and varieties on Growth Parameters of Groundnut Crop during *rabi* Season

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(Received: 08 June 2023; Revised: 25 June 2023; Accepted: 23 July 2023; Published: 15 August 2023)
(Published by Research Trend)

ABSTRACT: A field experiment was conducted at Agro Climate Research centre (ACRC), Agricultural Research Institute (ARI), Rajendranagar, Professor Jayashankar Telangana State Agricultural University (PJTSAU), Hyderabad to investigate the impact of different dates of sowing and varieties on the growth parameters of groundnut crop during the *rabi* season 2022-2023. The experiment was laid out in split plot design with main plots three sowing dates: D_1 -22nd October, 2022, D_2 - 7th November, 2022, and D_3 - 22nd November, 2022 and five subplots with five varieties: V_1– TMV-13, V_2– VRI-10, V_3– DH-256, V_4– GJG-33, and V_5– K-6 and replicated three times. The results revealed that the plant height at physiological maturity of groundnut was significantly higher in the crop sown on 22nd November, 2022 (44.7 cm) than that of crop sown on 22nd October, 2022 (39.7 cm) and 7th November, 2022 (41.3 cm). However, dates of sowing had no significant influence on leaf area of groundnut cropat physiological maturity. Drymatter production at physiological maturity was significantly higher in crop sown on22nd Oct, 2022 (6267 kg ha^{-1}) than that of crop sown on7th Nov, 2022 (5800kg ha^{-1}) and 22nd Nov, 2022 (5395kg ha^{-1}).

Among the varieties, plant height at physiological maturity significantly higher in variety K-6 than that of VRI-10, DH-256 and GJG-33 but on par with TMV-13. However, leaf area (cm^2 plant^{-1}) at harvest was significantly higher in theK-6 (1456.2 cm^2 plant^{-1}) than that of TMV -13 (1045.9 cm^2 plant^{-1}) and GJG-33(1203.4 cm^2 plant^{-1}) but on par with VRI-10 (1256.2 cm^2 plant^{-1}) and DH-256 (1230.4 cm^2 plant^{-1}) and for drymatter production (kg ha^{-1}) at physiological maturity was significantly higher in variety DH-256 (6043 kg ha^{-1}) than that of TMV-13 (5778 kg ha^{-1}), VRI-10 (5606kg ha^{-1}) and GJG-33 (5725 kg ha^{-1}) but on par with K-6 variety (5952 kg ha^{-1}).

Keywords: Plant height, leaf area and drymatter production.

INTRODUCTION

The Groundnut is a valuable food and oilseed crop. It is commonly called as the king of vegetable oilseeds crops or poor man's nut. It belongs to family Leguminosae. Groundnut appeared to have originated in South America (Shendage *et al*., 2018). The terminology of nut is used due its unusual growing habit where flowers are formed above ground (soil) and after fertilization the gynoecium penetrates the soil and forms pods which contain kernels (Prasad and Kakani 2010). Groundnut kernels contain 42 per cent to 50 per cent oil, 26 per cent protein, 18 per cent carbohydrates and also rich source of riboflavin, thiamine, nicotinic acid and vitamin E (Kathirvelan and Kalaiselvan 2007). Being rich in fat and protein, it is considered as a cheap source of nutritive food for the under-nourished, poverty-stricken population to overcome protein-energy malnutrition (Sardana and Kandhola 2007). The seed is used mainly for edible oil and contains nearly half of the essential vitamins and one-third of the essential minerals (Murugan and Nisha 2016).

The growth and yield of a crop is influenced by various factors but climate stands out as the most critical determinant. Among the climatic elements, solar radiation, temperature, humidity, and rainfall play indispensable roles in shaping the crop's development and productivity. Among the different management factors, sowing time plays a key role in obtaining higher yield. The optimum time is mainly dependent on prevailing agroclimatic conditions of an area (Banik *et al*., 2009). Long days promote vegetative growth at the expense of reproductive growth and increased crop

growth rate resulting in decreased partitioning of photosynthesis to pods and decreased duration of effective pod filling phase (Nigam *et al*., 1998).

The best time to sow groundnut depends on the particular variety and the current growing season, considering the variations in agro-climatic zones and agro-ecological conditions. Hence, adjustment of sowing date is very important to optimize climatic environment in respect to growth and yield of groundnut crop (Kumar *et al*., 2020). Keeping this in view, the present investigation was framed to study the effect of sowing dates on performance of groundnut (*Arachis hypogaea* L.) varieties in *rabi* season.

MATERIALS AND METHODS

The present field investigation was carried out during *rabi,* 2022-2023 to study the performance of popular groundnut (*Arachis hypogea* L.) varieties under different dates of sowing during *rabi* season. The present experiment was carried out at ACRC, ARI, Rajendranagar, PJTSAU, Hyderabad. Experiment was laid out in split plot design with three replications with 15 treatment combinations comprising of three sowing dates in main plot and five varieties as sub plot treatments. The treatment details of main plot D_1- 22nd Oct, 2022 D_2- 7th Nov, 2022 and D_3- 22nd Nov, 2022 and five varieties V_1- TMV -13, V_2- VRI -10, V_3- DH -256, V_4- GJG -33 and V_5- K -6 in subplots. The seeds were sown with 30 x 7.5 cm spacing. Data on parameters like plant height (cm), leaf area (cm^2 $plant^{-1}$), total dry matter production (kg ha^{-1}) were collected. From the collected data leaf area index (LAI), leaf area duration (LAD) and Crop growth rate (CGR) were calculated. The statistical analysis was carried out by using "Analysis of variance techniques". The significance was tested by 'F' value at 5 % level of significance. The value of critical difference (C.D.) for examining treatment means for their significance was done at 5 % level.

RESULTS AND DISCUSSION

A. Growth parameters

(i) Plant height (cm). Data on periodical mean plant height of groundnut as influenced by sowing dates and varieties are presented in Table 1. The plant height was increased significantly upto crop maturity with advancement of growth.

Effect of sowing dates on plant height (cm). It is evident that from the data presented table 1. indicates that at 1st flower bud appearance the plant height of groundnut crop was influenced by sowing dates. The data revealed that the plant height was significantly higher on 22nd Nov, 2022 (14.8 cm) than that of crop sown on 22nd Oct, 2022 (12.1cm) and 7th Nov, 2022 (13.5 cm).

At 50% flowering, higher plant height was recorded in the crop sown on 22nd Nov, 2022 (16.9 cm) than that of crop sown on 22nd Oct, 2022 (14.7 cm) and 7th Nov, 2022 (15.2 cm). However, lowest plant height was recorded on 22nd Oct, 2022 (14.7 cm) but it was on par with 7th Nov, 2022 (15.2 cm).

Perusal of data on plant height at pod formation stage of groundnut noticed that significantly higher plant height was recorded when sown on 22nd Nov, 2022 (35.9 cm) than that of the crop sown on 22nd Oct, 2022 (31.3 cm) but on par with 7th Nov, 2022 (33.8 cm). Similarly, at physiological maturity data indicated that significantly higher plant height was when sown on 22nd Nov, 2022 (44.7 cm) than that of crop sown on 22nd Oct, 2022 (39.7 cm) and 7th Nov, 2022 (41.3 cm). However, lowest plant height was recorded on 22nd Oct, 2022 (39.7 cm) but it was on par with 7th Nov, 2022 (41.3cm). The higher plant height on 22nd Nov, 2022 might be due to longer vegetative growth in late sown crop. The delay in sowing resulted in a noticeable increase in plant height. Which prompted an accelerated of vegetative growth stage. As a consequence, the plants had limited time for reproductive growth. These findings are similar with (Joshi and Patel 1985); Jangilwad *et al*. (2015). They reported that significantly lower plant height (cm) was recorded under early sown crop over rest of sowing dates.

(ii) Effect of varieties on plant height(cm). The data furnished in Table 1 indicated that plant height (cm) was significantly influenced by different varieties. Plant height at 1st flower bud appearance of groundnut was significantly higher in K-6 variety (14.4 cm) than DH-256 (12.7 cm), GJG-33 (12.2 cm) but on par with TMV- 13 (40 cm) and VRI-10 (13.8 cm). However, lowest plant height was recorded with variety GJG-33 (12.2 cm) and it was on par with DH-256 (12.7 cm). At 50% flowering, significantly higher plant height (16.8 cm) was recorded with K-6 than DH-256 (15.2 cm) and GJG-33 (14.5 cm) but on par with TMV-13 (15.8 cm) and VRI-10 (15.6 cm). However, lowest plant height was recorded with variety GJG-33(14.5 cm).

At pod formation stage K-6 (36.0 cm) recorded significantly higher plant height which is on par with the varieties TMV- 13 (34.5 cm) and VRI-10 (34 cm). However, lowest plant height was recorded with variety GJG-33 (31.5 cm) which is on par with DH-256 (32.4 cm). Similarly, at physiological maturity significantly higher plant height was recorded in K-6 (46.4 cm) thanVRI-10 (42.2 cm), GJG-33 (37.2 cm) and DH-256 (39.7 cm) which is on par with the TMV-13 (44.1cm). However, lowest plant height was recorded with variety GJG-33 (37.2 cm) but on par with the DH-256 (39.7 cm).

The interaction effect of dates of sowing and varieties had no significant influence on plant height (cm).

(ii) Leaf area (cm^2 $plant^{-1}$).

Effect of sowing dates on leaf area (cm^2 $plant^{-1}$). Perusal of the data from the Table 1 revealed that the dates of sowing had significant influence on the leaf area (cm^2plant^{-1}) at 1st flower bud appearance of groundnut. The data revealed that the leaf area was significantly higher on 22nd Oct, 2022 (226.4cm^2 $plant^{-1}$) than that of crop sown on 22nd Nov, 2022 (201.0 cm^2 $plant^{-1}$) and on par with the 7th Nov, 2022 (216.1 cm^2 $plant^{-1}$). However, lowest leaf area (cm^2 $plant^{-1}$) was recorded on 22nd Nov, 2022 (201.0 cm^2 $plant^{-1}$) it is on par with 7th Nov, 2022 (216.1 cm^2 $plant^{-1}$).

At 50% flowering significantly higher leaf area (cm^2 $plant^{-1}$) on 22nd Oct, 2022 (480.0 cm^2 $plant^{-1}$) than that of crop sown on 22nd Nov, 2022 (353.3 cm^2 $plant^{-1}$) but on par with 7th Nov, 2022 (401.3 cm^2 $plant^{-1}$). However, lowest leaf area was recorded on 22nd Nov, 2022 (353.3 cm^2 $plant^{-1}$) which was on par with the 7th Nov, 2022 (401.3 cm^2 $plant^{-1}$).

At pod formation stage of groundnut crop significantly higher leaf area (cm^2 $plant^{-1}$) on 22nd Oct, 2022 (1648.7 cm^2 $plant^{-1}$) than that of crop sown on 7th Nov, 2022 (1442.5 cm^2 $plant^{-1}$) and 22nd Nov, 2022 (1400.1 cm^2 $plant^{-1}$). However, lowest leaf area was recorded on 22nd Nov, 2022 (1400.1 cm^2 $plant^{-1}$) which was on par with the 7th Nov, 2022 (1442.5 cm^2 $plant^{-1}$) and at physiological maturity stage dates of sowing had no significant influence on leaf area of groundnut crop. This results in according to Raagavalli *et al*. (2019); Mohite *et al*. (2017).

Effect of varieties on leaf area (cm^2 $plant^{-1}$). Scrutiny of the data in Table 1 revealed that the varieties had significant influence on the leaf area (cm^2plant^{-1}) at 1st flower bud appearance of groundnut. Among the varieties, K-6 (228.8 cm^2 $plant^{-1}$) recorded significantly higher leaf area (cm^2) than TMV -13 (213.1 cm^2 $plant^{-1}$), VRI-10 (208.7 cm^2 $plant^{-1}$) and GJG-33(203.3 cm^2 $plant^{-1}$) but on par with DH-256 (218.5 cm^2 $plant^{-1}$) of groundnut variety. However, lowest leaf area was recorded with GJG-33(203.3 cm^2 $plant^{-1}$) and it was on par with TMV -13 (213.1 cm^2 $plant^{-1}$) and VRI-10 (208.7 cm^2 $plant^{-1}$).

At 50% flowering dates of sowing had no significant influence on the leaf area (cm^2 $plant^{-1}$). At pod formation stage of groundnut crop significantly higher leaf area (cm^2 $plant^{-1}$) with variety K-6 (1621.4 cm^2 $plant^{-1}$) than that of TMV -13 (1486.5 cm^2 $plant^{-1}$) and GJG-33(1331.1 cm^2 $plant^{-1}$) but on par withVRI-10 (1521.3 cm^2 $plant^{-1}$) and DH-256 (1525.1 cm^2 $plant^{-1}$). Similarly at physiological maturity stage varieties had significant influence on leaf area (cm^2 $plant^{-1}$) and among the varieties K-6 (1456.2 cm^2 $plant^{-1}$) recorded significantly higher leaf area than that of TMV -13 (1045.9 cm^2 $plant^{-1}$) and GJG-33(1203.4 cm^2 $plant^{-1}$) but on par with VRI-10 (1256.2 cm^2 $plant^{-1}$) and DH-256 (1230.4 cm^2 $plant^{-1}$). This occurrence might be attributed to the combination of genetic characteristics and favourable weather conditions during the crop growth duration. Results are corroborated with those reported by Mohith *et al*. (2017)

All the tested varieties responded in a similar trend hence, the interaction effect of dates of sowing and the varieties on leaf area (cm^2) the of groundnut was found non-significant.

(iii) Drymatter production (kg ha^{-1}). Data pertaining to drymatter production of groundnut crop as influenced by different dates of sowing and varieties at 1st flower bud appearance, 50% flowering, pod formation stage and at physiological maturity was presented in Table 1.

Effect of sowing dates on drymatter production (kg ha^{-1}). It is apparent from the data (Table 1) that the different sowing dates were significantly effect on dry matter production at all crop growth stages. At 1st flower bud appearance of groundnut significantly higher dry matter production (750 kg ha^{-1}) was noticed when crop sown on 22nd Oct, 2022 than that of crop sown on 22nd Nov, 2022 (489kg ha^{-1}) but on par with the crop sown on 7th Nov, 2022 (663kg ha^{-1}).

At 50% flowering, dry matter production was significantly influenced by dates of sowing and higher dry matter production was reported on 22nd Oct, 2022 (1394 kg ha^{-1}) than that of crop sown on 7th Nov, 2022 (1047 kg ha^{-1}) and 22nd Nov, 2022 (748 kg ha^{-1}).

At pod formation stage, highest dry matter production was recorded on 22nd Oct, 2022 (6047 kg ha^{-1}) than that of crop sown on 7th Nov, 2022 (5364 kg ha^{-1}) and 22nd Nov, 2022 (4975 kg ha^{-1}). However lowest dry matter production was recorded on 22nd Nov, 2022 (4975 kg ha^{-1}) and on par with 7th Nov, 2022 (5364 kg ha^{-1}).

And at physiological maturity stage significantly higher drymatter production was recorded under 22nd Oct, 2022 (6267 kg ha^{-1}) than that of crop sown on 22nd Nov, 2022 (5800kg ha^{-1}) and 7th Nov, 2022 (5395 kg ha^{-1}). Higher total dry matter production in early sowing might be due to higher leaf area and optimum average temperature as compared to other sowing dates. This finding is also in conformity with the findings of Ahmed (1992); Chandru *et al*. (2021); Patel *et al*. (2013); Deka *et al*. (1997); Baskaran *et al*. (2020).

Effect of varieties on drymatter production (kg ha^{-1}). Varieties had significant influence on drymatter production at 1st flower bud appearance, 50% flowering, pod formation stage and at physiological maturity was presented in Table 1. At 1st flower bud appearance significantly higher dry matter production recorded under K-6 variety (716kg ha^{-1}) than that of VRI-10 (621kg ha^{-1}), DH-256(619kg ha^{-1}) and GJG-33 (558kg ha^{-1}) but on par with TMV-13 (657kg ha^{-1}). However, lowest drymatter production was reported inGJG-33 (558kg ha^{-1}) but on par with VRI-10 (621kg ha^{-1}),

At 50% flowering, dry matter production was significantly in DH-256 (1186 kg ha^{-1}) than that of TMV-13 (899 kg ha^{-1}) and GJG-33 (950 kg ha^{-1}) but on par with. VRI-10 (1118kg ha^{-1}) and K-6 variety (1162kg ha^{-1}). However, lowest dry matter production was reported in TMV-13 (899 kg ha^{-1}) which is on par with GJG-33 (950 kg ha^{-1}).

At pod formation stage, the highest dry matter production was recorded significantly in DH-256(5915 kg ha^{-1}) than that of TMV-13 (5145 kg ha^{-1}) and GJG-33 (4941kg ha^{-1}) but on par with. VRI-10 (5436kg ha^{-1}) and K-6 variety (5872kg ha^{-1}). Similarly at physiological maturity stage varieties had significant influence on dry matter production and among the varieties DH-256 (6043 kg ha^{-1}) recorded significantly higher dry matter production than that of TMV-13 (5778 kg ha^{-1}), VRI-10 (5606kg ha^{-1}) and GJG-33 (5725kg ha^{-1}) but on par with K-6 variety (5952 kg ha^{-1}). However, lowest dry matter production was reported in GJG-33 (5725 kg ha^{-1}) and it was on par with TMV-13 (5778 kg ha^{-1}) and VRI-10 (5606kg ha^{-1}). This finding is also in conformity with the findings of Ahmed (1992); Chandru *et al*. (2021).

At all crop growth stages, the interaction effect of dates of sowing and varieties on dry matter production was found to be non-significant.

(iv) Leaf area index

Effect of sowing dates on leaf area index. The pertinent to the data on leaf area index was furnished in Table 2. The results revealed that at 1st flower bud appearance of groundnut significantly higher leaf area index (1.04) was noticed on 22nd Oct, 2022 than that of crop sown on 22nd Nov, 2022 (0.89) and 7th Nov, 2022 (0.96). However, lowest leaf area index was recorded on 22nd Nov, 2022 (0.89) and it is on par with 7th Nov, 2022 (0.96).

At 50% flowering, leaf area index significantly higher when crop sown on 22nd Oct, 2022 (2.13) than that of crop sown on 22nd Nov, 2022 (1.57) and on par with the 7th Nov, 2022 (1.78). However, lowest leaf area index was recorded on 22nd Nov, 2022 (1.57) it is on par with 7th Nov, 2022 (1.78).

At pod formation stage, the highest leaf area index was recorded on 22nd Oct, 2022 (7.33) than that of crop sown on 7th Nov, 2022 (6.41) and 22nd Nov, 2022 (6.22). However, lowest leaf area index was recorded on 22ndNov, 2022 (6.22) it is on par with 7th Nov, 2022 (6.41) and at physiological maturity stage, significantly higher leaf area index was recorded under crop sown on 22nd Oct, 2022 (5.69) but on par with 7th Nov, 2022 (5.26) and 22nd Nov, 2022 (5.57). Increase in leaf area increases LAI, which further increases LAD. This finding is also conformity with the findings of Raagavalli *et al*. (2019).

Effect of varieties on leaf area index. The examination of the analyzed data reveals that the leaf area index at1st flower bud appearance stage exhibited a noteworthy increase in variety VRI-10(0.93) and it was on par with TMV-13(0.91), DH-256(0.92), GJG-33(0.92) and K-6(0.92). At 50% flowering stage, significantly higher leaf area index was recorded in variety VRI-10(1.68) and it was on par with TMV-13(1.57), DH-256(1.62), GJG-33(1.62) and K-6 (1.64). However, lowest leaf area index was observed in TMV-13(1.57) variety and it was on par with DH-256(1.62), GJG-33(1.62) and K-6 (1.64).

At pod formation stage the data revealed that among the examined groundnut varieties, K-6 (7.21) exhibited a significantly higher leaf area index compared to TMV-13 (6.61) and GJG-33 (5.92). However, K-6 is on par with leaf area index to VRI-10 (6.76) and DH-256 (6.78) groundnut variety and at physiological maturity stage significantly higher leaf area index was reported in K-6 (6.27) than that of TMV-13(4.65) but on par with VRI-10(5.58), DH-256(5.62) and GJG-33(5.40). However, lowest leaf area index in TMV-13(4.65) which is on par with VRI-10(5.58), DH-256(5.62) and GJG-33(5.40).

At all crop growth stages, the interaction effect of dates of sowing and varieties on leaf area index was found to be non-significant.

(v) Leaf area duration

Effect of sowing dates on leaf area duration. Data on leaf area duration (days) as influenced by dates of sowing and varieties are presented in Table 2. Upon analyzing the data, it becomes apparent that there was a significant increase in the leaf area duration on October 22nd, 2022 (15.1) than that of crops sown on November 22nd, 2022 (13.4) but on par with November 7th, 2022 (14.4) at flower bud appearance stage.

At 50% flowering stage, significantly higher leaf area duration was recorded on October 22nd, 2022 (13.2) compared to crops sown on November 7th, 2022 (9.7) and November 22nd, 2022 (8.5). However, the lowest leaf area duration on November 22nd, 2022 (8.5) which is on par with November 7th, 2022 (9.7).

At pod formation stage, the revealed that highest leaf area duration on October 22nd, 2022 (189.3) than that of crops sown on November 22nd, 2022 (168.5) but on par with November 7th, 2022 (180.6). However, the lowest leaf area duration on November 22nd, 2022 (168.5) which is on par with November 7th, 2022 (180.6) and at physiological maturity significantly higher leaf area duration was recorded on October 22nd, 2022 (156.1) than that of crops sown on November 7th, 2022 (121.9) and November 22nd, 2022 (119.9). However, the lowest leaf area duration on November 22nd, 2022 (119.9) which is on par with November 7th, 2022 (121.9). Higher leaf area duration in early sowing might be due to higher leaf area during early sowings. Notably, similar results were reported by Raagavalli *et al*. (2019), further supporting the findings of this study.

Effect of varieties on leaf area duration. The pertinent data to leaf area duration by the influence of varieties was tabulated in Table 2. At 1st flower bud appearance among all varieties K-6 (15.3) exhibited a significantly higher leaf area duration compared to TMV-13 (14.2), VRI-10 (13.9) and GJG-33 (13.6) but on par with DH-256 (14.6). At 50% flowering, leaf area duration had no significant influence on varieties.

At pod formation stage, the revealed that highest leaf area duration was reported in DH-256(188.9) than that of GJG-33 (162.5) but on par with TMV-13 (181.0), VRI-10 (181.1) and K-6(183.8) and at physiological maturity significantly higher leaf area duration was resulted in DH-256(155.6) than that ofTMV-13 (108.4), VRI-10 (114.1) but on par with GJG-33 (138.9) and K-6(146.2).

At all crop growth stages, the interaction effect of dates of sowing and varieties on leaf area duration was found to be non-significant.

(vi) Crop growth rate($gm^{-2}day^{-1}$)

Effect of sowing dates on crop growth rate. Perusal of the data from the Table 2 revealed that the dates of sowing had significant influence on crop growth rate at 1st flower bud appearance of groundnut. The revealed that significantly higher crop growth rate was recorded on October 22nd, 2022(3.2) than that of November 7th, 2022 (2.7) and November 22nd, 2022 (1.9). At 50% flowering, significantly higher crop growth rate was reported on October 22nd, 2022(11.3) than that of crop sown on November 7th, 2022 (7.3) and November 22nd, 2022 (3.5).

Table 1: Influenced of dates of sowing and varieties on plant height, leaf area and drymatter production of groundnut.

Treatment	Plant height (cm)				Leaf area (cm^2 $plant^{-1}$)				Drymatter production (kg ha^{-1})			
	At 1st Flower bud initiation	At 50% flowering stage	At Pod formation stage	At physiological maturity stage	At 1st Flower bud initiation	At 50% flowering stage	At Pod formation stage	At physiological maturity stage	At 1st Flower bud initiation	At 50% flowering stage	At Pod formation stage	At physiological maturity stage
Main factor: Dates of sowing												
D_1- 22nd Oct, 2022	12.1	14.7	31.3	39.7	226.4	480	1648.7	1279.8	750	1394	6047	6267
D_2- 7th Nov, 2022	13.5	15.2	33.8	41.3	216.1	401.3	1442.5	1183.1	663	1047	5364	5800
D_3- 22nd Nov, 2022	14.8	16.9	35.9	44.7	201	353.3	1400.1	1252.3	489	748	4975	5395
SEm ±	0.3	0.3	0.6	0.6	3.9	13.8	41.1	60.71	22	28	102	16
CD (P=0.05)	1.2	1.2	2.3	2.6	15.8	55.4	165.6	N/A	89	113	411	66
Sub factor: Varieties												
V_1- TMV-13	14	15.8	34.5	44.1	213.1	402.6	1486.5	1045.9	657	899	5145	5778
V_2- VRI-10	13.8	15.6	34	42.2	208.7	372.9	1521.3	1256.2	621	1118	5436	5606
V_3- DH-256	12.7	15.2	32.4	39.7	218.5	458.7	1525.1	1230.2	619	1186	5915	6043
V_4- GJG-33	12.2	14.5	31.5	37.2	203.3	408	1331.1	1203.4	558	950	4941	5725
V_5- K6	14.4	16.8	36	46.4	228.8	415.5	1621.4	1456.2	716	1162	5872	5952
SEm ±	0.4	0.5	0.7	0.9	4.6	20.3	43.2	83.5	22	46	191	67
CD (P=0.05)	1.2	1.3	2	2.6	13.4	N/A	126.8	245.1	64	136	561	199
Interaction (Factor (D) at same level of V)												
SEm ±	0.7	0.8	1.2	1.5	8.8	34.3	78.5	142.9	40	77	313	136
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Interaction (Factor(V) at same level of D)												
SEm ±	0.7	0.7	1.3	2.3	8.1	30.7	91.8	135.8	49	63	228	117
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 2: Influenced of dates of sowing and varieties on leaf area index, leaf area duration and crop growth rate of groundnut.

Treatment	Leaf area index				Leaf area duration				Crop growth rate			
	At 1st Flower bud initiation	At 50% flowering stage	At Pod formation stage	At physiological maturity stage	At 1st Flower bud initiation	At 50% flowering stage	At Pod formation stage	At physiological maturity stage	At 1st Flower bud initiation	At 50% flowering stage	At Pod formation stage	At physiological maturity stage
Main factor: Dates of sowing												
D_1- 22nd Oct, 2022	1.04	2.13	7.33	5.69	15.1	13.2	189.3	156.1	3.2	11.3	16.4	15.5
D_2- 7th Nov, 2022	0.96	1.78	6.41	5.26	14.4	9.7	180.6	121.9	2.7	7.3	15.1	15.2
D_3- 22nd Nov, 2022	0.89	1.57	6.22	5.57	13.4	8.5	168.5	120.0	1.9	3.5	14.7	11.5
SEm ±	0.02	0.06	0.18	0.28	0.3	0.8	3.8	5.5	0.1	0.6	0.4	0.9
CD (P=0.05)	0.07	0.24	0.72	1.09	1.0	3.4	15.1	22.3	0.2	2.3	NS	NS
Sub factor: Varieties												
V_1- TMV-13	0.91	1.57	6.61	4.65	14.2	11.0	181.0	108.4	2.9	4.5	14.7	14.0
V_2- VRI-10	0.93	1.68	6.76	5.58	13.9	9.7	181.1	114.7	2.5	9.2	15.4	16.6
V_3- DH-256	0.92	1.62	6.78	5.62	14.6	10.2	188.9	155.6	2.4	9.7	16.3	12.7
V_4- GJG-33	0.92	1.62	5.92	5.4	13.6	10.2	162.5	138.9	2.2	5.9	14.2	12.3
V_5- K6	0.92	1.64	7.21	6.27	15.3	11.3	183.8	146.2	3.1	7.7	16.3	14.8
SEm ±	0.02	0.09	0.19	0.36	0.3	1.0	5.7	6.9	0.1	1.0	0.6	1.4
CD (P=0.05)	0.06	0.26	0.56	1.05	0.9	NS	16.8	20.3	0.3	3.0	NS	NS
Interaction (Factor (D) at same level of V)												
SEm ±	0.05	0.2	0.45	0.81	0.7	2.3	12.8	12.1	0.2	2.0	1.4	3.0
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Interaction (Factor(V) at same level of D)												
SEm ±	0.04	0.16	0.33	0.63	0.5	1.7	10	12.3	0.1	1.8	1.1	2.4
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Both pod formation and physiological maturity stages dates of sowing had no significant influence on crop growth rate. Decrease of CGR with the delay sowing might be due to reduction of total dry matter production. Similar results were reported by Meena (2017).

Effect of varieties on crop growth rate. Varieties had significant influence on crop growth rate at all crop growth stages of groundnut was presented in Table 2. At 1st flower bud appearance significantly higher crop growth rate was reported in variety K-6 (3.1) than that of VRI-10(2.5), DH-256(2.4) and GJG-33(2.2) but on par with TMV-13(2.9). At 50% flowering significantly higher crop growth rate was noticed in variety DH-256 (9.7) than that of TMV-13(4.5) and GJG-33(5.9) but on par with VRI-10(9.2) and K-6 (7.7).Both pod formation stage and physiological maturity stage varieties had no significant influence on crop growth rate.

All the tested varieties responded in a similar trend hence, the interaction effect of dates of sowing and the varieties on crop growth rate of groundnut was found non-significant.

CONCLUSIONS

Based on response of groundnut to different sowing dates and varieties in respect to growth parameter, The following conclusions can be drawn.

Among the sowing dates the plant height at harvest of groundnut was significantly higher in the crop sown on 22nd November, 2022 (44.7 cm) than that of on 22nd October, 2022 (39.7 cm) and 7th November, 2022 (41.3 cm). However, dates of sowing had no significant influence on leaf area of groundnut cropat harvest and drymatter production at harvest was significantly higher on 22nd Oct, 2022 (8890 kg ha^{-1}) than that of crop sown on 22nd Nov, 2022 (7044 kg ha^{-1}) and 7th Nov, 2022 (8278 kg ha^{-1}).

Among the varieties, plant height at harvest was significantly higher in K-6 (46.4 cm) than that of VRI-10 (42.2 cm), GJG-33 (37.2 cm) and DH-256 (39.7 cm) which is on par with the TMV-13 (44.1cm). However, lowest plant height was recorded with variety GJG-33 (37.2 cm) but on par with the DH-256 (39.7 cm). However, leaf area (cm^2 $plant^{-1}$) at harvest was significantly higher in theK-6 (1456.2 cm^2 $plant^{-1}$) than that of TMV -13 (1045.9 cm^2 $plant^{-1}$) and GJG-33(1203.4 cm^2 $plant^{-1}$) but on par with VRI-10 (1256.2 cm^2 $plant^{-1}$) and DH-256 (1230.4 cm^2 $plant^{-1}$) and drymatter production (kg ha^{-1}) at harvest were significantly higher in variety DH-256 (8639 kg ha^{-1}) than that of TMV-13 (7581 kg ha^{-1}) and GJG-33 (7522 kg ha^{-1}) but on par with. VRI-10 (8210kg ha^{-1}) and K-6 variety (8400 kg ha^{-1}).

FUTURE SCOPE

Investigating the impact of changing climatic conditions on groundnut cultivation during the rabi season. Analyzing how temperature and precipitation variations affect crop growth and identifying adaptation strategies.

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How to cite this article: S. Vyshnavi, K. Indudhar Reddy, S.G. Mahadevappa and G. Kiran Reddy (2023). Effect of Dates of Sowing and varieties on Growth Parameters of Groundnut Crop during *rabi* Season. *Biological Forum – An International Journal*, *15*(8a): 51-57.