Original Research Article

PERFORMANCE OF GROUNDNUT VARIETIES UNDER VARIOUS SOWING WINDOWS FOR CROP GROWTH, DEVELOPMENTIN WESTERN MAHARASHTRA

ABSTRACT

The present experiment was carried out at Department of Agricultural Meteorology Farm, Centre of Advanced Faculty Training, College of Agriculture, Pune, MPKV, Rahuri for assessment of different groundnut varieties for crop growth, development and yields under various sowing windows in Western Maharashtra Plain Zone during the Kharif season of 2017 and 2018.The experiment was laid out in split plot design with three replications. The treatment comprised of four varieties *viz.,* V_1: JL-501, V_2: RHRG-6083 (*Phule Unnati*), V_3: TAG-24 and V_4: JL-776 (*Phule Bharati*) as main plot and four sowing windows *viz*., S_1: 25th MW, S_2: 26th MW, S_3: 27th MW and S_4: 28th MW as sub plot treatments.From the result of the study, all the growth attributes were increased with the advancement in age of the groundnut crop. Plant height 35.27 and 33.34 cm, total number branches 11.34 and 10.55, total dry matter accumulation plant^{-1}34.36 and 32.11 g during both the years of experiment, which were found significantly higher in variety JL-776 over RHRG-6083, JL-501 and TAG-24. Among all the sowing windows 26th MW (S_2) sowing window recorded the highest growth attributes *viz.,* plant height (33.67 and 31.94 cm), total number of branches plant^{-1} (11.34 and 10.58 g) and total dry matter accumulation plant^{-1} (34.75 and 32.78 g) during both year of experiment. 26th MW sowing window was at par with the 27th MW sowing window with all growth attributes. Pod yield (26.59 and 28.14 q ha^{-1}) and haulm yield (39.61 and 36.7 q ha^{-1}) were significantly higher in variety in JL-776 followed by RHRG-6083, JL-501 and TAG-24. Pod yield (27.25 and 28.84 q ha^{-1}) and haulm yield (40.60 and 37.61 q ha^{-1}) was higher in 26th MW sowing window, which were at par with 27th MW sowing window during both the year.

Key words: Growth, Phenology, Yield, Sowing window, Crop weather relationship, Post harvest character

1. INTRODUCTION

Groundnut is essentially a tropical plant and requires a long and warm growing season. The favourable climate for groundnut is a well distributed rainfall of at least 500 mm during the crop growing season with abundance of sunshine and relatively warm temperature, which is essential for maximum yield and quality of groundnut. Groundnut crop grows under wide range of temperatures and requires a long and warm growing season.Sowing, flowering and reproductive phases require an average rainfall distribution of 100, 150 and 400-500 mm, respectively. Moisture stress during vegetative period delays flowering, pod setting and results in low yields. High atmospheric humidity stimulates more flowering which results in increased peg setting. Pod development stage is most sensitive to moisture deficit.Pod yield is significantly influenced by day length. 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 [1]. Sowing of rainfed and irrigated crop early in the season provide favourable weather conditions for proper growth and yield of groundnut. Delay in sowing by one-week results in linear decrease in pod yield of groundnut. In normal-sown crop, the pattern of flowering is regular with two distinct peaks of flowering, whereas in late-sown crop erratic pattern of flowering occurs [2].The choice of a groundnut variety for any particular area depends on matching the variety with the length of the growing season. Groundnut varieties whose growth cycle is longer than the duration of growing season at a particular location either fail to mature or mature at a time when soil is too hard to dig the pods, therefore the investigation is carried out to assess the different groundnut varieties for crop growth, development and yields under various sowing windows in Western Maharashtra Plain Zone.

2. MATERIAL AND METHODS

2.1 Location of the Experimental Site, Soil and Climatic Condition

The field experiment was conducted for two consecutive years at Department of Agricultural Meteorology farm, College of Agriculture, Pune during *kharif,* 2017 and 2018. The geographical location of the site (Pune) was 18° 32'N, latitude; 73°51E, longitude and 557.7 m above mean sea level (MSL). The soil is medium black having depth of about 1m. The experimental site is situated in the sub-tropical region (Plain Zone) on the latitude 18^0 22' N and longitude 73^0 51' E and having an altitude of 557.7 m above the mean sea level. The average annual rainfall of Pune is 675 mm, which is distributed from second fortnight of June to second fortnight of October. Out of total rainfall, about 75 per cent is received from June to September from south-west monsoon, while remaining is received from north-east monsoon during October and November.

2.2 Nature of Season During Experimental Period

Daily and weekly mean meteorological data during the crop growth period (25^{th} to 45^{th} MW) of *kharif* 2017 and 2018 recorded in class 'A' observatory situated in the adjoining field. The daily maximum and minimum temperature during the crop growth period ranged from 34.4 and 12.7 ^oC during *kharif* 2017 and 34.7 and 13.3 ^oC during *kharif* 2018. During crop period, the weekly maximum and minimum temperatures varied from 27.1 to 33.4 ^oC and 14.1 to 23.9 ^oC, respectively, during 2017. It was varied from 24.2 to 37.7 ^oC and 13.3 to 24.6 ^oC respectively, during *kharif* 2017. Weekly relative humidity during morning (07.20 hrs LMT) and afternoon (14.20 hrs LMT) was 93.7 and 31.1 % in 2017, whereas it was 97 and 16 % in *kharif* 2018, respectively. The daily range of relative humidity during morning was 75-97 % and 72-97 % during the respective years while during afternoon was in the range of 26-98 %, while, it was between 16-92 % during two years of experimentation, respectively. The weekly wind velocity during the period ranged from 1.6 to 10.3 and 1.1 to 11.6 kmph during 2017 and 2018, respectively. The bright sunshine hour's day^{-1} during crop growing period were 9.3 and 10.5 during 2017 and 2018, respectively. The weekly evaporation ranged from 2.2 to 6.7 and 2.2 to 5.3 mm per day in 2017 and 2018, respectively. The weekly photoperiod *i.e.* maximum possible sunshine hours which were fixed for the particular day in a year ranged from 10.38 to 13.87.

2.3 Experimental Details

The experiment was laid out in split plot design with three replications. The treatment comprised of four varieties *viz.,* V_1: JL-501, V_2: RHRG-6083 (*Phule Unnati*), V_3: TAG-24 and V_4: JL-776 (*Phule Bharati*) as main plot and four sowing windows *viz*., S_1: 25^{rd} MW (18^{th} to 24^{th} June), S_2: 26^{th} MW (25^{th} June to 01^{st} July), S_3: 27^{th} MW (2^{nd} to 8^{th} July) and S_4: 28^{th} MW (09^{th} to 15^{th} July) as sub plot treatments. The gross and net plot size was 4.5 x 4.5 m^2 and 3.6 x 3.6 m^2, respectively. The allocation of treatments was done with random method. The certified seed of all the groundnut variety JL-501, RHRG-6083, TAG-24 and JL-776 was procured from the Groundnut Breeder, Oilseed Research Station, Jalgaon, MPKV, Rahuri. Sowing was done as per the treatments by dibbling one kernel at each hill with 30 cm inter-row and 7.5 cm intra-row distance keeping a seed rate of 100 $kgha^{-1}$. The requisite plant population was maintained by thinning and gap filling where ever necessary. Urea and single super phosphate were used as source of N and P and applied as per recommended dose *i.e.*25 kg N and 50 kg P_2O_5. Seed of groundnut was inoculated with *Rhizobium* culture @ 250 g 10 kg^{-1} seed.

2.4 Growth Studies

Plant height (cm) was measured from the base of main stem to the base of apical bud of the plant at the end of various physiological growth stages, number of branches $Plant^{-1}$was counted from each observation plant from branching stage to physiological maturity and for determining dry matter accumulation plant^{-1} (g)plant parts were sundried and then allow drying in thermostatically controlled hot air oven at 60 $\pm 2^{o}$C till constant weight was recorded. The dry matter study was carried out at the end of each growth stage during the period experiment.

2.5 Phenological Studies

The number of days from sowing to 50 per cent of the plants in the plot showed flowering was recorded by observing plants from net plot and number of days required from sowing to physiological maturity of pods was recorded by observing plants from net plot.

2.6 YieldStudies

Pods from net plot were stripped after uprooting and dried in sunlight. The pod yield obtained was recorded as per treatments and pod yield^{-1}was calculated.After stripping pods, haulms from net plot area of each treatment were sun dried and expressed quintal^{-1}.

3. RESULTS AND DISCUSSION

The biometric observations of groundnut were recorded on various growth characters *viz.,* plant height (cm) (Table 1), number of branches plant^{-1}(Table 2), dry matter (g)(Table 3), days to 50 per cent flowering and days to maturity (Table 4) at regular interval of 28, 42, 56, 70, 84 days after sowing (DAS) and at harvest.

3.1 Plant Height (cm)

The mean plant height increased as the crop advanced in age. The mean plant height increased from 28 DAS (4.35 cm) to harvest (32.13 cm) during 2017 and from 28 DAS (3.91 cm) to harvest (30.23 cm) during 2018

3.1.1 Effect of varieties

The mean plant height differences due to varieties were significant at all the stages of crop growth. It could be observed that at all the stages of crop growth, variety JL-776 (V_4) recorded significantly higher plant height (35.27 and 33.34 cm). This was followed by RHRG-6083 (V_2) (34.19 and 32.34) and JL-501 (V_1) (29.90 and 27.99 cm) during the year, 2017 and 2018, respectively. Plant height in variety TAG-24 (V_3) (29.15 and 27.26 cm) was found significantly the lowest among all varieties at all the growth stages of crop.This suggested that the variety JL-776 suitably acclimatize in soil and agro climatic conditions of Pune region thus, exploiting its potential in term of growth and development. Further, increase in plant height in groundnut is genetically governed phenomena affecting hormonal balance, nutrient absorbing capacity and photosynthetic ability. All these processes were reflected in height and other yield contributing characters. Increase in plant height due to favourable weather situations like higher GDD, photo thermal and heliothermal units which facilitates better growth.

3.1.2 Effect of sowing windows

The mean plant height was significantly influenced throughout the crop growth period by different growing environments created through different sowing windows.The maximum plant height (34.15 and 32.27 cm) was recorded in 26^{th} MW (S_2) sowing window and it was at par with 25^{th} MW sowing window (32.90 and 30.94 cm) i.e. (S_1) this was followed by 27^{th} MW sowing window (31.52 and 29.64 cm) and 28^{th} MW sowing window (29.94 and 28.07 cm) during the year 2017 and 2018, respectively.The plant height was increased very fast in between 28 to 70 DAS which might be due to active vegetative growth phase of the plant and at slow rate beyond 70 DAS as the plant enter from initial vegetative phase to reproductive phase. It can be concluded that plant height in the second sowing window (S_2) was significantly superior as compared to rest of the sowing windows during the crop growth period. It might be due to suitable weather conditions of different weather parameters during crop growing period. Plant height decreased significantly with delay in sowing. Reduced plant height with delay in sowing may be due to quick changes in photoperiod, which accelerated development towards reproductive stage and hence less time was available for vegetative growth. These results are similar to those reported by [3].

3.1.3 Effect of interaction

The plant height (cm) at all the stages of crop growth was significantly influenced by interaction between varieties and sowing windows during both the years. 26th MW sowing window (S_2) recorded higher plant height (36.55 and 38.48 cm) in variety JL-776 (V_4) which was followed by variety RHRG-6083 (V_2) (33.65 and 35.48 cm), JL-501 (V_1) (29.98 and 31.81 cm) and TAG-24 (V_3) (28.91 and 30.84 cm) during both the years 2017 and 2018, respectively.

3.2 Number of Branches Plant^{-1}

The mean number of branches plant^{-1} was progressively increased with advancement of the age of the crop, 10.27 and 9.44 at harvest during the year, 2017 and 2018, respectively.

3.2.1 Effect of varieties

The mean number of branches plant^{-1} as influenced due to varieties was significant at all the stages of crop growth. It could be observed that significantly higher number of branches plant^{-1} was observed in var. JL-776 (V_4) (11.34 and 10.55) followed by var. RHRG-6083 (V_2) (10.73 and 9.89) and JL=501 (V_1) (9.62 and 8.78). Lower number of branches plant^{-1} was observed in var. TAG-24 (V_3) (9.39 and 8.55 cm) at harvest during the year 2017 and 2018, respectively. This difference in varietal performance may be attributed to genotypic variation affecting branching pattern and duration.

3.2.2 Effect of sowing windows

The maximum number of branches plant^{-1} of groundnut (11.34 and 10.58 cm) was recorded in 26th MW (S_2) sowing window and it was at par with 25th MW sowing window (10.61 and 9.77 cm) *i.e.* (S_1) which was followed by 27th MW sowing window (10.01 and 9.17 cm) and 28th MW sowing window (9.12 and 8.25 cm) during 2017 and 2018, respectively.The number of branches plant^{-1} of groundnut was increased very fast in between 28 to 56 DAS which might be due to active vegetative growth phase of the plant and at slow rate beyond 56 DAS as the plant enter from initial vegetative phase to reproductive phase. It was observed that number of branches plant^{-1} in the sowing window (S_2) was significantly superior as compared to rest of the sowing windows during the crop growth period. It might be due to suitable weather conditions of different weather parameters during crop growing period. Number of branches plant^{-1} decreased significantly with delay in sowing. Reduced number of branches plant^{-1} with delay in sowing may be due to quick changes in photoperiod, which accelerated development towards reproductive stage and hence less time was available for vegetative growth [4] and [5].

3.2.3 Effect of interaction

The number of branches plant^{-1} of groundnut at all the stages of crop growth was significantly influenced by interaction between varieties and sowing windows during both the years.26th MW sowing window (S_2) recorded higher number of branches plant^{-1} of groundnut (12.45 and 12.98 cm) in var. JL-776 (V_4) which was followed by var. RHRG-6083 (V_2) (10.80 and 11.64 cm), JL-501 (V_1) (9.75 and 10.59 cm) and TAG-24 (V_3) (9.31 and 10.15 cm) during the year 2017 and 2018, respectively.

3.3 Total Dry Matter Accumulation Plant^{-1} (g)

During the crop growing period, increase in dry matter weight was continuous with the advancement in the crop age up to harvest of crop. The rate of increase was rapid during flowering and reproductive period.The mean dry matter of groundnut plant^{-1} at harvest during both the years of 2017 and 2018, was 30.88 and 29.02 (g), respectively.

3.3.1 Effect of varieties

The mean dry matter plant^{-1}of groundnut as influenced due to varieties were significant at all the stages of crop growth. It could be observed that at harvest, variety JL-776 (V_4) recorded significantly higher dry matter plant^{-1} (g) of groundnut (34.36 and 32.81 g) followed by RHRG-6083 (V_2) (31.08 and 29.11 g) and JL-501 (V_1) (29.75 and 27.78 g), whereas it was lowest in var. TAG-24 (V_3) (28.33 and 26.36 g) at harvest of crop during 2017 and 2018, respectively. This was consequent to significant growth and yield parameters of variety JL-776 which exploited its full potential under present agro-climatic condition since, dry matter accumulation is the result of all growth and yield attributes.

3.3.2 Effect of sowing windows

The maximum dry matter accumulation plant^{-1} (34.75 and 32.78 g)was recorded in 26th MW (S_2) sowing window and it was at par with 25th MW sowing window (S_1) (31.67 and 29.7 g) *i.e.* (S_1) this was followed by 27th MW sowing window (29.58 and 27.61 g) and 28th MW sowing window (27.53 and 25.97 g) during the year 2017 and 2018, respectively.The dry matter accumulation plant^{-1} of groundnut was increased very fast in between 28 to 56 DAS which might be due to active vegetative growth phase of the plant and at slow rate beyond 56 DAS as the plant enter from initial vegetative phase to reproductive phase. The dry matter accumulation plant^{-1} of groundnut in the sowing window (S_2) was significantly superior as compared to rest of the sowing windows during the crop growth period. It might be due to suitable weather conditions of different weather parameters during crop growing period.Dry matter accumulation plant^{-1} of groundnut decreased significantly with delay in sowing. Reduced dry matter accumulation plant^{-1} of groundnut with delay in sowing may be due to quick changes in photoperiod, which accelerated development towards reproductive stage and hence less time was available for vegetative growth. At all the stages of growth, the dry matter weight plant^{-1} (g) showed decreasing trend with late sowings (S_2 to S_4). Besides, growth period of the crop also decreased with each successive delay in sowing which was also caused reduction in dry matter accumulation in late sowings. From all the observations it is observed that the sowing window 26th (MW) *i.e.* treatment S_2 was significantly superior over all the other sowing window treatments. The vegetative growth and dry matter production were less in extended sowing windows. This decreased growth period might have reduced dry matter production with late sowing.They indicated July 7 as the optimum date of sowing and observed the highest net assimilation ratio and photosynthesis ratio at this sowing date. Similar results were reported by [5] and [6].

3.3.3 Effect of interaction

The dry matter accumulation plant-^{1}of groundnut at all the stages of crop growth was significantly influenced by interaction between varieties and sowing windows during both the years. 26th MW sowing window (S_2) recorded higher dry matter accumulation plant^{-1} of groundnut (41.03 and 43 g) in variety JL-776 (V_4) which was followed by variety RHRG-6083 (V_2) (31.36 and 33.33 g), JL-501 (V_1) (31.03 and 33.0 g) and TAG-24 (V_3) (29.03 and 31.0 g) during the year 2017 and 2018 respectively.

3.4 Days to 50 Per Cent Flowering and Maturity

Data regarding mean days to 50 per cent flowering and maturity of groundnut as influenced significantly by the different treatments are presented. The mean days to 50 per cent flowering were 32.98 and 32.48 during the year 2017 and 2018, respectively. The mean days to maturity were 108.46 and 107.68 for 2016 and 2017, respectively (Table 2).

3.4.1 Effect of varieties

Days to 50 percent flowering and days to maturity were influenced significantly due to different groundnut varieties. Maximum number of days to 50 per cent flowering (36 and 35.63) was observed in variety JL-776 (V_4) which was significantly higher. This was followed by var. RHRG-6083 (V_2) (33.92 and 33.38) and JL-501 (V_1) (31.17 and 30.63), while var. TAG-24 (V_3) was recorded significantly lower (30.83 and 30.29) during the year 2017 and 2018, respectively.Maximum number of days to maturity (113.08 and 111.75) was observed in variety JL-776 (V_4) which was significantly higher. This was followed by RHRG-6083 (V_2) (111.42 and 110.66) and JL-501 (V_1) (106.58 and 103.91), while var. TAG-24 (V_3) was recorded significantly lower (102.75 and 102.41) during the year 2017 and 2018, respectively.

3.4.2 Effect of sowing windows

The days to 50 per cent flowering (35.08 and 34.54) was observed significantly higher in 26th MW sowing window. This was followed by 25th MW sowing window at (33.67 and 33.13), 27th MW sowing window (32.67 and 32.13) and 28th MW sowing window (30.5 and 30.13) during the year 2017 and 2018, respectively.The days to maturity (111.83 and 110.91) was observed significantly higher in 26th MW sowing window. This was followed by 25th MW sowing window at (109.83 and 109.16), 27th MW sowing window (107.58 and 106.64) and 28th MW sowing window (104.58 and 104.3) during the year 2017 and 2018, respectively.The similar results were observed by [6] at the time of sowing groundnut in *Kharif* season and indicated that the sowing groundnut in the second fortnight of June and first fortnight of July gave highest flower production. Later sowings reduced flower production.In any given locality, early sowings in first fortnight of July resulted in early flowering and early maturity[7].Similar result was recorded by [8] in the field trials conducted on peanut cultivars of early and late maturing varieties sown at seven days intervals and concluded that the July sowings emerged faster and required less time to reach flowering and early harvesting.

3.4.3 Effects of interaction

The days to 50 per cent flowering and days to maturity was significantly influenced by interaction between varieties and sowing windows during the year 2017 and 2018. Sowing at 26th MW sowing window (S_2) recorded maximum days to 50 per cent flowering (37.79 and 38.33) in variety JL-776 (V_4). This was followed by variety RHRG-6083 (V_2) (35.46 and 36.0), JL-501 (V_1) (32.46 and 33.0), and TAG-24 (V_3) (32.24 and 33.0) during the year 2017 and 2018 respectively.Sowing at 26th MW sowing window (S_3) recorded maximum days to maturity (115.66 and 117) in variety JL-776 (V_4). This was followed by variety RHRG-6083 (V_2) (113.66 and 114.67), JL-501 (V_1) (108.66 and 109.33), and TAG-24 (V_3) (105.66 and 106.33) during 2017 and 2018 respectively.

3.5 Yield Studies

3.5.1 Pod yield (kgha^{-1})

The mean pod yield of groundnut was 24.32 and 25.71 q ha^{-1} was recordedduring the year 2017 and 2018, respectively (Table5).

3.5.1.1 Effect of varieties

The pod yield was significantly higher in JL-776 (V_4) (26.59 and 28.14 q ha^{-1}) which was significantly superior rest of the groundnut varieties. This was followed by RHRG-6083 (V_2) (25.75 and 27.13 q ha^{-1}), JL-501 (V_1) (22.75 and 24.08 q ha^{-1}). The variety TAG-24 recorded significantly lower pod yield (22.19 and 23.49 q ha^{-1}) during the year 2017 and 2018, respectively. The differences in pod yield of groundnut varieties might be due to inherent genetical potential of variety.

3.5.1.2 Effect of sowing windows

The pod yield of groundnut was influenced significantly due to extended sowing windows. The pod yield was maximum at 26th MW (S_2) sowing window (27.25 and 28.84 q ha^{-1}) and was at with 27th MW (25.89 and 27.27 q ha^{-1}). This was followed by 25th MW sowing window (23.35 and 24.72 q ha^{-1}) and 28th MW sowing window (20.79 and 22.01 q ha^{-1}) during the year 2017 and 2018, respectively. A sowing window of 26th MW was favourable to maximum pod production because of favourable weather condition. Similar results were reported by [5] and [9].

3.5.1.3 Effects of interaction

The pod yield (q ha^{-1}) was significantly influenced by interaction between varieties and sowing windows during the year 2017 and 2018. Sowing at 26th MW sowing window (S_2) recorded maximum pod yield (32.49 and 30.70 q ha^{-1}) in variety JL-776 (V_4). This was followed by variety RHRG-6083 (V_2) (29.96 and 28.30 q ha^{-1}), JL-501 (V_1) (26.86 and 25.38 q ha^{-1}), and TAG-24 (V_3) (26.04 and 24.60 q ha^{-1}) during the year 2017 and 2018, respectively. There results showed that delay in sowing of groundnut varieties could not able to assimilate the more biomass resulted in reduced pod yield of groundnut.

3.5.2 Haulm yield(kgha^{-1})

The mean haulm yield of groundnut was 36.24 and 33.49 qha^{-1} during the year 2017 and 2018, respectively (Table 5).

3.5.2.1 Effect of varieties

The haulm yield of groundnut was influenced significantly due to groundnut varieties. The haulm yield was significantly higher in JL-776 (V_4) (39.61 and 36.7 qha^{-1}) and significantly superior rest of the groundnut varieties. This was followed by RHRG-6083 (V_2) (38.37 and 35.23 q ha^{-1}), JL-501 (V_1) (33.9 and 31.41 q ha^{-1}). The variety TAG-24 recorded significantly lower haulm yield (33.07 and 30.64 qha^{-1}) during the year 2017 and 2018, respectively. The differences in haulm yield of groundnut varieties might be due to inherent genetical potential of groundnut variety.

3.5.2.2 Effect of sowing windows

The haulm yield of groundnut was influenced significantly due to extended sowing windows. The haulm yield was maximum at 26th MW sowing window (40.60 and 37.61 q ha^{-1}), this was followed by 27th MW (38.57 and 35.41 q ha^{-1}) were at par with 25th MW sowing window. This was followed by 25th MW sowing window (34.80 and 32.24 q ha^{-1}) and 28th MW sowing window (30.98 and 28.71 q ha^{-1}) during the year 2017 and 2018, respectively. A sowing window of 26th MW was favourable to high haulm production because of favourable weather condition. The results are similar to those reported by [10].

3.5.2.3 Effects of interaction

The haulm yield (q ha^{-1}) was significantly influenced by interaction between varieties and sowing windows during the year 2017 and 2018. Sowing at 26th MW sowing window (S_2) recorded maximum haulm yield (42.38 and 45.74 q ha^{-1}) in variety JL-776 (V_4). This was followed by variety RHRG-6083 (V_2) (39.08 and 42.17 q ha^{-1}), JL-501 (V_1) (35.04 and 37.82 q ha^{-1}) and TAG-24 (V_3) (33.97 and 36.66 q ha^{-1}) during the year 2017 and 2018, respectively. These results showed that delay in sowing of groundnut varieties could not able to assimilate the more biomass resulted in reduced haulm yield of groundnut.

Table 1: Plant height (cm) of groundnut as influenced periodically by different treatments.

Treatment	28 DAS			42 DAS			56 DAS			70 DAS			84 DAS			At harvest		
	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled
A) Main plot: Varieties																		
V_1: JL-501	4.31^{bc}	3.88^{bc}	4.09^{bc}	10.14^{b}	9.25^{bc}	9.70^{bc}	20.34^{c}	18.83^{c}	19.59^{c}	24.31^{c}	23.69^{c}	24.00^{c}	29.42^{b}	27.69^{b}	28.55^{b}	29.90^{b}	27.99^{b}	28.94^{b}
V_2: RHRG-6083	4.37^{b}	3.94^{ab}	4.16^{b}	10.36^{b}	9.47^{ab}	9.92^{ab}	21.50^{b}	20.05^{b}	20.78^{b}	25.47^{b}	24.85^{b}	25.16^{b}	33.75^{a}	32.02^{a}	32.89^{a}	34.19^{a}	32.34^{a}	33.26^{a}
V_3: TAG-24	4.25^{c}	3.82^{c}	4.03^{c}	10.03^{b}	9.14^{c}	9.59^{c}	19.76^{d}	18.34^{d}	19.05^{d}	23.78^{d}	23.16^{d}	23.47^{d}	28.67^{b}	26.94^{b}	27.80^{b}	29.15^{b}	27.26^{b}	28.21^{b}
V_4: JL-776	4.46^{a}	4.01^{a}	4.24^{a}	10.83^{a}	10.11^{a}	10.47^{a}	22.05^{a}	20.59^{a}	21.32^{a}	26.12^{a}	25.44^{a}	25.78^{a}	34.83^{a}	33.00^{a}	33.92^{a}	35.27^{a}	33.34^{a}	34.30^{a}
S. E.±	0.02	0.02	0.02	0.11	0.17	0.11	0.12	0.09	0.07	0.14	0.13	0.09	0.61	0.59	0.42	0.63	0.65	0.45
C. D. at 5 %	0.08	0.08	0.05	0.38	0.6	0.32	0.40	0.31	0.23	0.47	0.44	0.29	2.12	2.03	1.31	2.18	2.24	1.39
B) Sub plot: Sowing windows																		
S_1: 25th MW	4.50^{a}	4.08^{a}	4.29^{a}	11.08^{a}	10.21^{a}	10.65^{a}	21.14^{b}	19.67^{b}	20.40^{b}	25.60^{b}	24.98^{b}	25.29^{b}	32.42^{b}	30.69^{b}	31.55^{b}	32.90^{b}	30.94^{b}	31.92^{b}
S_2: 26th MW	4.39^{b}	3.95^{b}	4.17^{b}	10.68^{a}	9.81^{a}	10.25^{a}	21.86^{a}	20.39^{a}	21.12^{a}	26.39^{a}	25.83^{a}	26.11^{a}	33.67^{a}	31.94^{a}	32.80^{a}	34.15^{a}	32.27^{a}	33.21^{a}
S_3: 27th MW	4.29^{c}	3.86^{c}	4.08^{c}	10.04^{b}	9.17^{b}	9.60^{b}	20.54^{c}	19.07^{c}	19.81^{c}	24.54^{c}	23.92^{c}	24.23^{c}	31.08^{c}	29.35^{b}	30.22^{c}	31.52^{c}	29.64^{c}	30.58^{c}
S_4: 28th MW	4.20^{d}	3.75^{d}	3.98^{d}	9.56^{c}	8.79^{c}	9.18^{c}	20.12^{d}	18.69^{d}	19.40^{d}	23.15^{d}	22.42^{d}	22.79^{d}	29.50^{d}	27.66^{d}	28.58^{d}	29.94^{d}	28.07^{d}	29.00^{d}
S. E.±	0.02	0.02	0.01	0.14	0.09	0.08	0.07	0.06	0.05	0.08	0.09	0.06	0.23	0.24	0.17	0.22	0.22	0.16
C. D. at 5 %	0.05	0.06	0.04	0.40	0.27	0.23	0.2	0.18	0.13	0.25	0.26	0.17	0.68	0.7	0.47	0.65	0.64	0.44
C) Interaction (A×B)																		
S_1V_1	3.93^{cde}	4.36^{def}	4.14^{cdef}	9.52^{cde}	10.39^{cde}	9.96^{cdefg}	18.92^{e}	20.39^{f}	19.65^{f}	24.52^{ef}	25.14^{ef}	24.83^{ef}	27.94^{hij}	29.67^{hi}	28.80^{hi}	28.22^{gh}	30.15^{hi}	29.18^{hi}
S_2V_1	3.98^{bcd}	4.41^{cde}	4.20^{cde}	9.69^{bcde}	10.56^{bcde}	10.13^{cde}	20.19^{c}	21.66^{cd}	20.93^{c}	25.19^{cd}	25.81^{cd}	25.50^{cd}	29.60^{fg}	31.33^{fg}	30.47^{fg}	29.98^{ef}	31.81^{fg}	30.90^{fg}
S_3V_1	3.87^{defg}	4.30^{efgh}	4.09^{efgh}	9.04^{def}	9.91^{def}	9.48^{efghi}	18.32^{fg}	19.79^{gh}	19.06^{gh}	23.38^{h}	24.00^{hi}	23.69^{ij}	26.94^{jk}	28.67^{ij}	27.80^{ij}	27.22^{hi}	29.15^{ij}	28.18^{ij}
S_4V_1	3.72^{i}	4.15^{i}	3.94^{i}	8.75^{ef}	9.71^{ef}	9.23^{ghi}	17.91^{h}	19.53^{ghi}	18.72^{hi}	21.66^{i}	22.28^{j}	21.97^{k}	26.27^{kl}	28.00^{jk}	27.14^{jk}	26.55^{ij}	28.48^{jk}	27.52^{jk}
S_1V_2	4.01^{bc}	4.44^{bcd}	4.22^{bcd}	9.82^{bcd}	10.69^{bcd}	10.26^{bcd}	20.33^{c}	21.80^{c}	21.07^{c}	25.46^{c}	26.08^{c}	25.77^{c}	32.94^{bcd}	34.67^{bcd}	33.80^{bcd}	33.22^{bcd}	35.15^{bc}	34.18^{bc}
S_2V_2	4.10^{b}	4.53^{b}	4.32^{b}	10.00^{bc}	10.87^{bc}	10.44^{bc}	20.85^{b}	22.32^{b}	21.58^{b}	26.45^{b}	27.07^{b}	26.76^{b}	33.27^{bc}	35.00^{bc}	34.14^{bc}	33.65^{bc}	35.48^{bc}	34.56^{bc}
S_3V_2	3.87^{defg}	4.30^{efgh}	4.09^{efgh}	9.20^{cde}	10.07^{cde}	9.64^{defghi}	19.79^{d}	21.26^{de}	20.53^{cd}	24.44^{efg}	25.06^{ef}	24.75^{ef}	31.60^{de}	33.33^{de}	32.47^{de}	31.93^{d}	33.64^{de}	32.78^{de}
S_4V_2	3.78^{fghi}	4.21^{hi}	4.00^{hi}	8.87^{def}	9.79^{def}	9.33^{fghi}	19.24^{e}	20.61^{f}	19.93^{f}	23.06^{h}	23.68^{i}	23.37^{j}	30.27^{ef}	32.00^{ef}	31.14^{ef}	30.55^{e}	32.48^{ef}	31.52^{ef}
S_1V_3	3.85^{efgh}	4.28^{fgh}	4.07^{fgh}	9.43^{cde}	10.30^{cde}	9.86^{cdefgh}	18.46^{f}	19.93^{g}	19.20^{g}	23.91^{g}	24.53^{g}	24.22^{gh}	27.60^{ijk}	29.33^{hij}	28.47^{hij}	27.88^{ghi}	29.81^{hij}	28.85^{hij}
S_2V_3	3.91^{cdefg}	4.34^{defg}	4.13^{defg}	9.57^{cde}	10.44^{cde}	10.01^{cdef}	18.95^{e}	20.42^{f}	19.68^{f}	24.17^{fg}	24.79^{fg}	24.48^{fg}	28.60^{ghi}	30.33^{gh}	29.47^{gh}	28.91^{fg}	30.84^{gh}	29.88^{gh}
S_3V_3	3.80^{efghi}	4.23^{ghi}	4.01^{ghi}	8.86^{ef}	9.73^{ef}	9.30^{fghi}	18.03^{gh}	19.50^{hi}	18.76^{hi}	23.01^{h}	23.63^{i}	23.32^{j}	26.60^{jk}	28.33^{ij}	27.47^{ij}	26.88^{hi}	28.81^{ij}	27.85^{ij}
S_4V_3	3.72^{hi}	4.15^{i}	3.94^{i}	8.71^{ef}	9.65^{ef}	9.18^{hi}	17.94^{h}	19.21^{i}	18.58^{i}	21.57^{i}	22.19^{j}	21.88^{k}	24.94^{l}	26.67^{k}	25.80^{k}	25.35^{j}	27.15^{k}	26.25^{k}
S_1V_4	4.02^{bc}	4.48^{bc}	4.25^{bc}	10.48^{b}	11.35^{b}	10.92^{b}	20.96^{b}	22.43^{b}	21.70^{b}	26.02^{b}	26.64^{b}	26.33^{b}	34.27^{b}	36.00^{b}	35.14^{b}	34.43^{b}	36.48^{b}	35.46^{b}
S_2V_4	4.32a	4.73a	4.53a	11.57a	12.44a	12.01a	21.57^{a}	23.04^{a}	22.31^{a}	27.51^{a}	27.91^{a}	27.71^{a}	36.27^{a}	38.00^{a}	37.14^{a}	36.55^{a}	38.48^{a}	37.52^{a}
S_3V_4	3.91^{cdef}	4.34^{defg}	4.13^{defg}	9.57^{cde}	10.44^{cde}	10.01^{cdef}	20.15^{c}	21.62^{cd}	20.89^{cd}	24.87^{de}	25.49^{de}	25.18^{de}	32.27^{cd}	34.00^{cd}	33.14^{cd}	32.55^{cd}	34.48^{cd}	33.52^{cd}
S_4V_4	3.78^{ghi}	4.29^{fgh}	4.04^{fghi}	8.82^{f}	9.10^{f}	8.96^{i}	19.67^{d}	21.11^{e}	20.39^{e}	23.38^{h}	24.46^{gh}	23.92^{hi}	29.18^{fgh}	31.33^{fg}	30.26^{fg}	29.81^{ef}	31.64^{fg}	30.72^{fg}
S. E.±	0.04	0.04	0.03	0.28	0.19	0.17	0.14	0.12	0.09	0.17	0.18	0.12	0.47	0.48	0.33	0.44	0.44	0.31
C. D. at 5%	0.11	0.12	0.08	0.81	0.55	0.47	0.4	0.36	0.26	0.49	0.51	0.34	1.36	1.4	0.95	1.3	1.28	0.89
GM	4.35	3.91	4.13	10.34	9.5	9.92	20.91	19.45	20.18	24.92	24.29	24.6	31.67	29.91	30.79	32.13	30.23	31.18

Note: Observations with same superscript are at par and with different superscript are significantly different.

Table 2: Mean number of branches plant^{-1} as influenced periodically by different treatments.

Treatment	28 DAS			42 DAS			56 DAS			70 DAS			84 DAS			At harvest		
	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled
A) Main plot: Varieties																		
V_1: JL-501	3.53^{bc}	3.22^{bc}	3.38^{bc}	4.91^{c}	4.44^{c}	4.67^{c}	8.31^{b}	7.25^{b}	7.78^{b}	9.53^{c}	8.39^{c}	8.96^{c}	9.54^{c}	9.08^{c}	9.31^{c}	9.62^{c}	8.78^{c}	9.20^{c}
V_2: RHRG-6083	3.85^{ab}	3.54^{ab}	3.69^{ab}	5.56^{b}	5.09^{b}	5.32^{b}	8.72^{ab}	7.66^{ab}	8.19^{ab}	10.80^{b}	9.66^{b}	10.23^{b}	10.80^{b}	10.34^{b}	10.57^{b}	10.73^{b}	9.89^{b}	10.31^{b}
V_3: TAG-24	3.42^{c}	3.11^{c}	3.27^{c}	4.69^{c}	4.22^{c}	4.46^{c}	7.77^{c}	6.71^{c}	7.24^{c}	9.36^{c}	8.22^{c}	8.79^{c}	9.39^{c}	8.93^{c}	9.16^{c}	9.39^{c}	8.55^{c}	8.97^{c}
V_4: JL-776	3.89^{a}	3.68^{a}	3.78^{a}	6.58^{a}	6.11^{a}	6.34^{a}	9.19^{a}	7.96^{a}	8.57^{a}	11.14^{a}	9.93^{a}	10.53^{a}	11.23^{a}	10.64^{a}	10.94^{a}	11.34^{a}	10.55^{a}	10.94^{a}
S. E.±	0.09	0.11	0.07	0.14	0.11	0.09	0.19	0.15	0.12	0.08	0.11	0.07	0.07	0.11	0.07	0.09	0.07	0.06
C. D. at 5 %	0.33	0.38	0.23	0.48	0.39	0.28	0.66	0.53	0.38	0.29	0.38	0.22	0.25	0.38	0.21	0.32	0.24	0.18
B) Sub plot: Sowing windows																		
S_1: 25^{th} MW	3.67^{ab}	3.36^{ab}	3.51^{ab}	5.89^{b}	5.33^{b}	5.61^{b}	8.79^{b}	7.73^{b}	8.26^{b}	10.61^{b}	9.47^{b}	10.04^{b}	10.61^{b}	10.15^{b}	10.38^{b}	10.61^{b}	9.77^{b}	10.19^{b}
S_2: 26^{th} MW	4.04^{a}	3.73^{a}	3.89^{a}	6.44^{a}	6.06^{a}	6.25^{a}	9.48^{a}	8.28^{a}	8.88^{a}	11.13^{a}	9.99^{a}	10.56^{a}	11.19^{a}	10.73^{a}	10.96^{a}	11.34^{a}	10.58^{a}	10.96^{a}
S_3: 27^{th} MW	3.67^{ab}	3.36^{ab}	3.51^{ab}	5.17^{c}	4.70^{c}	4.94^{c}	8.31^{c}	7.21^{c}	7.76^{c}	9.93^{c}	8.79^{c}	9.36^{c}	10.01^{c}	9.55^{c}	9.78^{c}	10.01^{c}	9.17^{c}	9.59^{c}
S_4: 28^{th} MW	3.32^{b}	3.10^{b}	3.21^{b}	4.23^{c}	3.76^{d}	3.99^{d}	7.41^{d}	6.35^{d}	6.88^{d}	9.16^{d}	7.95^{d}	8.56^{d}	9.16^{d}	8.58^{d}	8.87^{d}	9.12^{d}	8.25^{d}	8.69^{d}
S. E.±	0.14	0.13	0.09	0.17	0.19	0.13	0.14	0.11	0.09	0.11	0.12	0.08	0.13	0.15	0.1	0.14	0.13	0.09
C. D. at 5 %	0.4	0.38	0.27	0.48	0.57	0.36	0.4	0.33	0.25	0.33	0.34	0.23	0.37	0.43	0.27	0.39	0.37	0.26
C) Interaction (A×B)																		
S_1V_1	2.69^{d}	3.00^{cd}	2.85^{d}	4.70^{defgh}	5.17^{defgh}	4.94^{defgh}	7.38^{defg}	8.44^{defg}	7.91^{defg}	8.46^{fgh}	9.6^{fgh}	9.03^{fgh}	9.14^{cde}	9.60^{cde}	9.37^{cde}	8.76^{efgh}	9.60^{efgh}	9.18^{efgh}
S_2V_1	3.72^{ab}	4.03^{ab}	3.88^{ab}	5.21^{def}	5.68^{def}	5.45^{def}	7.67^{def}	8.73^{def}	8.20^{def}	9.16^{def}	10.30^{def}	9.73^{def}	9.88^{c}	10.34^{c}	10.11^{c}	9.75^{cd}	10.59^{cd}	10.17^{cd}
S_3V_1	3.44^{abcd}	3.75^{abcd}	3.60^{abcd}	4.05^{fgh}	4.52^{fgh}	4.29^{fgh}	7.17^{fgh}	8.23^{fgh}	7.70^{fgh}	8.26^{ghi}	9.40^{ghi}	8.83^{ghi}	8.94^{de}	9.40^{de}	9.17^{de}	8.56^{fghi}	9.40^{fghi}	8.98^{fghi}
S_4V_1	3.04^{bcd}	3.35^{bcd}	3.20^{bcd}	3.78^{ghi}	4.25^{ghi}	4.02^{ghi}	6.77^{ghi}	7.83^{ghi}	7.30^{ghi}	7.69^{ij}	8.83^{ij}	8.26^{ij}	8.37^{ef}	8.83^{ef}	8.60^{ef}	8.04^{hi}	8.88^{hi}	8.46^{hi}
S_1V_2	3.67^{abc}	3.98^{abc}	3.83^{abc}	5.63^{cde}	6.10^{cde}	5.87^{cde}	7.95^{cd}	9.01^{cd}	8.48^{cd}	10.07^{bc}	11.21^{bc}	10.64^{bc}	10.75^{b}	11.21^{b}	10.98^{b}	10.37^{bc}	11.21^{bc}	10.79^{bc}
S_2V_2	3.84^{ab}	4.15^{ab}	4.00^{ab}	6.95^{ab}	7.42^{ab}	7.19^{ab}	8.72^{b}	9.78^{b}	9.25^{b}	10.48^{b}	11.62^{b}	11.05^{b}	11.18^{b}	11.64^{b}	11.41^{b}	10.80^{b}	11.64^{b}	11.22^{b}
S_3V_2	3.42^{abcd}	3.73^{abcd}	3.58^{abcd}	5.03^{defg}	5.50^{defg}	5.27^{defg}	7.43^{defg}	8.49^{defg}	7.96^{defg}	9.28^{de}	10.42^{de}	9.85^{de}	9.96^{c}	10.42^{c}	10.19^{c}	9.58^{cde}	10.42^{cde}	10.00^{cde}
S_4V_2	3.22^{abcd}	3.53^{abcd}	3.37^{abcd}	2.73^{i}	3.20^{i}	2.97^{i}	6.53^{hi}	7.59^{hi}	7.06^{hi}	8.80^{efg}	9.94^{efg}	9.37^{efg}	9.48^{cd}	9.94^{cd}	9.71^{cd}	8.81^{efgh}	9.65^{efgh}	9.23^{efgh}
S_1V_3	3.27^{abcd}	3.58^{abcd}	3.43^{abcd}	4.46^{efgh}	4.93^{efgh}	4.7^{efgh}	7.20^{efgh}	8.26^{efgh}	7.73^{efgh}	8.70^{efg}	9.84^{efg}	9.27^{efg}	9.38^{cd}	9.84^{cd}	9.61^{cd}	9.00^{defg}	9.84^{defg}	9.42^{defg}
S_2V_3	3.36^{abcd}	3.67^{abcd}	3.51^{abcd}	4.86^{defgh}	5.33^{defgh}	5.10^{defgh}	7.35^{defg}	8.41^{defg}	7.88^{defg}	8.91^{efg}	10.05^{efg}	9.48^{efg}	9.69^{cd}	10.15^{cd}	9.92^{cd}	9.31^{def}	10.15^{def}	9.73^{def}
S_3V_3	3.02^{bcd}	3.33^{bcd}	3.18^{bcd}	3.86^{ghi}	4.33^{ghi}	4.10^{ghi}	6.46^{ij}	7.52^{ij}	6.99^{ij}	7.87^{hij}	9.01^{hij}	8.44^{hij}	8.55^{ef}	9.01^{ef}	8.78^{ef}	8.17^{ghi}	9.01^{ghi}	8.59^{ghi}
S_4V_3	2.81^{cd}	3.12^{cd}	2.96^{cd}	3.69^{hi}	4.16^{hi}	3.93^{hi}	5.82^{j}	6.88^{j}	6.35^{j}	7.42^{j}	8.56^{j}	7.99^{j}	8.10^{f}	8.56^{f}	8.33^{f}	7.72^{i}	8.56^{i}	8.14^{i}
S_1V_4	3.80^{ab}	4.11^{ab}	3.95^{ab}	6.53^{abc}	7.33^{abc}	6.93^{abc}	8.38^{j}	9.44^{bc}	8.91^{bc}	10.64^{b}	11.78^{b}	11.21^{b}	11.32^{b}	11.78^{b}	11.55^{b}	10.94^{b}	11.78^{b}	11.36^{b}
S_2V_4	4.02^{a}	4.33^{a}	4.17^{a}	7.20^{a}	7.33^{a}	7.27^{a}	9.38^{a}	11.00^{a}	10.19^{a}	11.42^{a}	12.56^{a}	11.99^{a}	12.15^{a}	12.61^{a}	12.38^{a}	12.45^{a}	12.98^{a}	12.71^{a}
S_3V_4	3.55^{abcd}	3.86^{abcd}	3.71^{abcd}	5.86^{bcd}	6.33^{bcd}	6.10^{bcd}	7.79^{a}	8.99^{cde}	8.39^{cde}	9.75^{cd}	10.89^{cd}	10.32^{cd}	10.74^{b}	11.20^{b}	10.97^{b}	10.36^{bc}	11.20^{bc}	10.78^{bc}
S_4V_4	3.34^{abcd}	3.27^{e}	3.31^{abcd}	4.83^{defgh}	5.30^{defgh}	5.07^{defgh}	6.27^{ij}	7.33^{ij}	6.8^{ij}	7.91^{hij}	9.33^{ghi}	8.62^{ghi}	8.36^{ef}	9.33^{def}	8.85^{def}	8.44^{fghi}	9.4^{fghi}	8.92^{fghi}
S. E.±	0.28	0.26	0.19	0.33	0.39	0.25	0.28	0.23	0.18	0.22	0.24	0.16	0.25	0.3	0.19	0.27	0.26	0.19
C. D. at 5%	NS	NS	0.54	0.97	1.13	0.72	0.81	0.67	0.5	0.65	0.69	0.46	0.73	0.86	0.55	0.79	0.75	0.53
GM	3.67	3.39	3.53	5.43	4.96	5.2	8.50	7.39	7.94	10.21	9.05	9.63	10.24	9.75	10	10.27	9.44	9.86

Note: Observations with same superscript are at par and with different superscript are significantly different.

Table 3: Mean dry matter plant^{-1} (g) as influenced periodically by different treatments.

Treatment	28 DAS			42 DAS			56 DAS			70 DAS			84 DAS			At harvest		
	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled
A) Main plot: Varieties																		
V_1: JL-501	2.14^{c}	2.09^{c}	2.12^{c}	5.62^{bc}	4.94^{bc}	5.28^{bc}	8.48^{bc}	7.55^{bc}	8.01^{bc}	12.44^{bc}	11.32^{bc}	11.88^{bc}	26.57^{bc}	25.2^{bc}	25.88^{bc}	29.75^{bc}	27.78^{bc}	28.77^{bc}
V_2: RHRG-6083	2.34^{b}	2.29^{b}	2.31^{b}	6.05^{b}	5.37^{b}	5.71^{b}	9.07^{ab}	8.14^{ab}	8.60^{ab}	12.83^{ab}	11.71^{ab}	12.27^{ab}	28.08^{b}	26.71^{b}	27.39^{b}	31.08^{b}	29.11^{b}	30.10^{b}
V_3: TAG-24	2.11^{c}	2.07^{d}	2.09^{c}	5.40^{c}	4.72^{c}	5.06^{c}	7.95^{c}	7.02^{c}	7.49^{c}	11.95^{c}	10.83^{c}	11.39^{c}	25.31^{c}	23.94^{c}	24.63^{c}	28.33^{c}	26.36^{c}	27.35^{c}
V_4: JL-776	2.56^{a}	2.54^{a}	2.55^{a}	6.88^{a}	6.12^{a}	6.50^{a}	9.40^{a}	8.31^{a}	8.86^{a}	13.24^{a}	11.95^{a}	12.60^{a}	31.90^{a}	30.23^{a}	31.06^{a}	34.36^{a}	32.81^{a}	33.58^{a}
S. E.±	0.05	0.07	0.04	0.17	0.21	0.13	0.18	0.21	0.14	0.19	0.15	0.12	0.51	0.65	0.42	0.82	0.68	0.54
C. D. at 5 %	0.18	0.23	0.13	0.58	0.72	0.41	0.61	0.72	0.42	0.66	0.53	0.38	1.77	2.26	1.28	2.84	2.37	1.65
B) Sub plot: Sowing windows																		
S_1: 25th MW	2.30^{b}	2.25^{b}	2.28^{b}	6.05^{b}	5.37^{b}	5.71^{b}	9.69^{a}	8.76^{a}	9.22^{a}	13.84^{a}	12.72^{a}	13.28^{a}	27.98^{b}	26.61^{b}	27.29^{b}	31.67^{b}	29.70^{b}	30.68^{b}
S_2: 26th MW	2.83^{a}	2.79^{a}	2.81^{a}	7.27^{a}	6.59^{a}	6.93^{a}	8.92^{b}	7.99^{b}	8.45^{b}	13.10^{b}	11.98^{b}	12.54^{b}	31.10^{a}	29.73^{a}	30.42^{a}	34.75^{a}	32.78^{a}	33.77^{a}
S_3: 27th MW	2.16^{b}	2.12^{b}	2.14^{b}	5.60^{c}	4.92^{c}	5.26^{c}	8.32^{c}	7.39^{c}	7.86^{c}	12.33^{c}	11.21^{c}	11.77^{c}	26.99^{bc}	25.62^{bc}	26.3b^{c}	29.58^{c}	27.61^{c}	28.60^{c}
S_4: 28th MW	1.85^{c}	1.83^{c}	1.84^{c}	5.03^{d}	4.27^{d}	4.65^{d}	7.98^{d}	6.88^{d}	7.43^{d}	11.19^{d}	9.90^{d}	10.55^{d}	25.79^{c}	24.12^{c}	24.96^{c}	27.53^{d}	25.97^{c}	26.75^{c}
S. E.±	0.07	0.06	0.05	0.11	0.13	0.08	0.14	0.16	0.11	0.15	0.17	0.11	0.56	0.52	0.38	0.69	0.68	0.48
C. D. at 5 %	0.21	0.19	0.14	0.31	0.37	0.24	0.42	0.46	0.3	0.42	0.49	0.31	1.65	1.53	1.09	2.03	1.98	1.38
C) Interaction (A×B)																		
S_1V_1	2.20^{cdefg}	2.25^{cdefg}	2.22^{cdefg}	5.07^{def}	5.75^{def}	5.41^{def}	7.67^{cde}	8.60^{cde}	8.14^{cde}	11.70^{cde}	12.82^{cde}	12.26^{cde}	25.43^{cdef}	26.8^{cdef}	26.12^{cdef}	28.36^{bcd}	30.33^{bcd}	29.35^{bcd}
S_2V_1	2.48^{bc}	2.53^{bc}	2.50^{bc}	5.92^{c}	6.60^{c}	6.26^{c}	8.19^{bcd}	9.12^{bcd}	8.66^{bcd}	12.27^{bcd}	13.39^{bcd}	12.83^{bcd}	27.20^{bcde}	28.57^{bcde}	27.88^{bcde}	31.03^{bc}	33.00^{b}	32.02^{bc}
S_3V_1	2.00^{defgh}	2.05^{defgh}	2.02^{defgh}	4.71^{fgh}	5.39^{fgh}	5.05^{fgh}	7.19^{defg}	8.12^{defg}	7.66^{defg}	10.96^{ef}	12.08^{ef}	11.52^{ef}	24.48^{bcd}	25.85^{def}	25.17^{def}	26.70^{cde}	28.67^{cde}	27.68^{cde}
S_4V_1	1.70^{h}	1.74^{h}	1.72^{h}	4.04^{hi}	4.72^{hi}	4.38^{hi}	7.13^{efg}	8.06^{efg}	7.59^{efg}	10.35^{fg}	11.47^{fg}	10.91^{fg}	23.68^{ef}	25.05^{ef}	24.37^{ef}	25.03^{de}	27.00^{de}	26.02^{de}
S_1V_2	2.28^{bcdef}	2.33^{bcdef}	2.31^{bcdef}	5.68^{cd}	6.36^{cd}	6.02^{cd}	8.45^{bc}	9.38^{bc}	8.92^{bc}	12.18^{bcd}	13.30^{bcd}	12.74^{bcd}	27.44^{bcd}	28.81^{bcd}	28.12^{bcd}	30.03^{bc}	32.00^{bc}	31.02^{bc}
S_2V_2	2.71^{b}	2.75^{b}	2.73^{b}	6.56^{b}	7.24^{b}	6.90^{b}	8.79^{b}	9.72^{b}	9.26^{b}	12.82^{b}	13.94^{b}	13.38^{b}	28.52^{bc}	29.89^{bc}	29.20^{bc}	31.36^{b}	33.33^{bc}	32.35^{b}
S_3V_2	2.22^{cdef}	2.27^{cdef}	2.25^{cdef}	5.02^{def}	5.70^{def}	5.36^{def}	7.81^{bcde}	8.74^{bcde}	8.28^{bcde}	11.36^{def}	12.48^{def}	11.92^{def}	26.55^{bcdef}	27.92^{bcdef}	27.23^{bcdef}	28.36^{bcd}	30.33^{bcd}	29.35^{bcd}
S_4V_2	1.94^{efgh}	1.99^{efgh}	1.96^{efgh}	4.22^{ghi}	4.90^{ghi}	4.56^{ghi}	7.49^{cdef}	8.42^{cdef}	7.96^{cdef}	10.46^{fg}	11.58^{fg}	11.02^{fg}	24.32^{def}	25.69^{def}	25.01^{def}	26.70^{cde}	28.67^{cde}	27.68^{cde}
S_1V_3	2.10^{cdefgh}	2.15^{cdefgh}	2.12^{cdefgh}	4.87^{efg}	5.55^{efg}	5.21^{efg}	7.34^{defg}	8.27^{defg}	7.81^{defg}	11.23^{def}	12.35^{def}	11.79^{def}	24.15^{def}	25.52^{def}	24.84^{def}	27.36^{bcde}	29.33^{bcde}	28.35^{bcde}
S_2V_3	2.45^{bcd}	2.49^{bcd}	2.47^{bcd}	5.56^{cde}	6.24^{cde}	5.90^{cde}	7.50^{cdef}	8.43^{cdef}	7.97^{cdef}	11.83^{bcde}	12.95^{bcde}	12.39^{bcde}	25.42^{cdef}	26.79^{cdef}	26.11^{cdef}	29.03^{bcd}	31.00^{bcd}	30.02^{bcd}
S_3V_3	1.90^{efgh}	1.94^{efgh}	1.92^{efgh}	4.54^{fghi}	5.22^{fghi}	4.88^{fghi}	6.78^{efg}	7.71^{efg}	7.25^{efg}	10.47^{fg}	11.59^{fg}	11.03^{fg}	23.14^{f}	24.51^{f}	23.83^{f}	25.36^{de}	27.33^{de}	26.35^{de}
S_4V_3	1.82^{fgh}	1.86^{fgh}	1.84^{fgh}	3.92^{i}	4.60^{i}	4.26^{i}	6.47^{fg}	7.40^{fg}	6.94^{fg}	9.81^{gh}	10.93^{gh}	10.37^{gh}	23.06^{f}	24.43^{f}	23.74^{f}	23.70^{e}	25.67^{e}	24.68^{e}
S_1V_4	2.43^{bcd}	2.48^{bcd}	2.46^{bcd}	5.87^{c}	6.55^{c}	6.21^{c}	8.48^{bc}	9.41^{bc}	8.95^{bc}	12.80^{bc}	13.92^{bc}	13.36^{bc}	29.40^{b}	30.77^{b}	30.09^{b}	31.70^{b}	33.67^{b}	32.68^{b}
S_2V_4	3.52^{a}	3.56^{a}	3.54^{a}	8.30^{a}	8.98^{a}	8.64^{a}	10.54^{a}	11.47^{a}	11.01^{a}	13.95^{a}	15.07^{a}	14.51^{a}	37.80^{a}	39.17^{a}	38.48^{a}	41.03^{a}	43.00^{a}	42.02^{a}
S_3V_4	2.34^{bcde}	2.39^{bcde}	2.37^{bcde}	5.43^{cde}	6.11^{cde}	5.77^{cde}	7.77^{bcde}	8.70^{bcde}	8.24^{bcde}	12.06^{bcde}	13.18^{bcde}	12.62^{bcde}	28.29^{bc}	29.66^{bc}	28.98^{bc}	30.03^{bc}	32.00^{bc}	31.02^{bc}
S_4V_4	1.87^{gh}	1.79^{gh}	1.83^{gh}	4.89^{efg}	5.90^{cdef}	5.39^{cdef}	6.44^{g}	8.03^{efg}	7.24^{efg}	9.00^{h}	10.78^{h}	9.89^{h}	25.42^{cdef}	28.00^{bcde}	26.71^{bcde}	28.46^{bcd}	28.77^{bcde}	28.62^{bcde}
S. E.±	0.14	0.13	0.10	0.22	0.26	0.17	0.29	0.32	0.21	0.29	0.34	0.22	1.13	1.05	0.77	1.39	1.36	0.97
C. D. at 5%	0.41	0.38	0.27	0.63	0.75	0.47	0.85	0.92	0.60	0.85	0.99	0.63	3.3	3.06	2.18	4.05	3.96	2.75
GM	2.29	2.25	2.27	5.99	5.29	5.64	8.73	7.75	8.24	12.61	11.45	12.03	27.96	26.52	27.24	30.88	29.02	29.95

Note: Observations with same superscript are at par and with different superscript are significantly different.

Table 4: Mean number of days to 50 % flowering and maturity as influenced by different treatments

Treatment	Days to 50 % flowering			Days to maturity		
	2017	2018	Pooled	2017	2018	Pooled
A) Main plot: Varieties						
V_1: JL-501	31.17^{c}	30.63^{c}	30.90^{c}	106.58^{c}	105.91^{c}	106.25^{c}
V_2: RHRG-6083	33.92^{b}	33.38^{b}	33.65^{b}	111.42^{b}	110.66^{b}	111.04^{b}
V_3: TAG-24	30.83^{c}	30.29^{c}	30.56^{c}	102.75^{d}	102.41^{d}	102.58^{d}
V_4: JL-776	36.00^{a}	35.63^{a}	35.81^{a}	113.08^{a}	111.75^{a}	112.42^{a}
S. E.±	0.13	0.19	0.12	0.25	0.28	0.21
C. D. at 5 %	0.45	0.66	0.36	0.85	0.96	0.65
B) Sub plot: Sowing windows						
S_1: 25^{th} MW	33.67^{b}	33.13^{b}	33.40^{b}	109.83^{b}	109.16^{b}	109.50^{b}
S_2: 26^{th} MW	35.08^{a}	34.54^{a}	34.81^{a}	111.83^{a}	110.91^{a}	111.37^{a}
S_3: 27^{th} MW	32.67^{c}	32.13^{c}	32.40^{c}	107.58^{c}	106.64^{c}	107.11^{c}
S_4: 28^{th} MW	30.50^{d}	30.13^{d}	30.31^{d}	104.58^{d}	104.03^{d}	104.30^{d}
S. E.±	0.28	0.25	0.19	0.21	0.19	0.13
C. D. at 5 %	0.82	0.74	0.54	0.6	0.55	0.36
C) Interaction (A×B)						
S_1V_1	31.13^{fg}	31.67^{fg}	31.40^{fg}	107.66^{g}	108.33^{g}	108.00^{f}
S_2V_1	32.46^{ef}	33.00^{ef}	32.73^{ef}	108.66^{e}	109.33^{e}	109.00^{e}
S_3V_1	30.13^{gh}	30.67^{gh}	30.40^{gh}	104.66^{i}	105.33^{i}	105.00^{i}
S_4V_1	28.79^{hi}	29.33^{hi}	29.06^{hi}	102.66^{k}	103.33^{k}	103.00^{k}
S_1V_2	34.13^{cd}	34.67^{cd}	34.40^{cd}	111.66^{c}	112.33^{c}	112.00^{c}
S_2V_2	35.46^{bc}	36.00^{bc}	35.73^{bc}	113.66^{b}	114.67^{b}	114.17^{b}
S_3V_2	33.13^{de}	33.67^{de}	33.40^{de}	109.66^{d}	110.33^{d}	110.00^{d}
S_4V_2	30.79^{g}	31.33^{g}	31.06^{g}	107.66^{g}	108.33^{g}	108.00^{g}
S_1V_3	31.13^{fg}	31.67^{fg}	31.40^{fg}	103.66^{j}	104.33^{j}	104.00^{j}
S_2V_3	32.24^{ef}	33.00^{ef}	32.73^{ef}	105.66^{h}	106.33^{h}	106.00^{h}
S_3V_3	30.13^{gh}	30.67^{gh}	30.40^{gh}	101.66^{l}	102.33^{l}	102.00^{l}
S_4V_3	27.46^{i}	28.00^{i}	27.73^{i}	98.66^{m}	98.00^{m}	98.33^{m}
S_1V_4	36.13^{b}	36.67^{b}	36.40^{b}	113.66^{b}	114.33^{b}	114.00^{b}
S_2V_4	37.79^{a}	38.33^{a}	38.06^{a}	115.66^{a}	117.00^{a}	116.33^{a}
S_3V_4	35.13^{bc}	35.67^{bc}	35.40^{bc}	110.55^{d}	112.33^{c}	111.44^{c}
S_4V_4	33.46^{de}	33.33^{de}	33.40^{de}	107.11^{f}	108.67^{f}	107.89^{f}
S. E.±	0.57	0.51	0.38	0.41	0.38	0.26
C. D. at 5%	NS	NS	1.08	1.21	1.10	0.73
General Mean	32.98	32.48	32.73	108.46	107.68	108.07

Note: Observations with same superscript are at par and with different superscript are significantly different.

Table 5: Mean pod and haulm yield (q ha^{-1}) of *kharif* groundnut as influenced by different treatments

Treatment	Pod yield (q ha^{-1})			Haulm yield (q ha^{-1})		
	2017	2018	Pooled	2017	2018	Pooled
A) Main plot: Varieties						
V_1: JL-501	22.75^{c}	24.08^{c}	23.42^{c}	33.90^{c}	31.41^{c}	32.65^{c}
V_2: RHRG-6083	25.75^{b}	27.13^{b}	26.44^{b}	38.37^{b}	35.23^{b}	36.80^{b}
V_3: TAG-24	22.19^{d}	23.49^{d}	22.84^{d}	33.07^{d}	30.64^{d}	31.85^{d}
V_4: JL-776	26.59^{a}	28.14^{a}	27.36^{a}	39.61^{a}	36.70^{a}	38.16^{a}
S. E.±	0.4	0.43	0.29	0.6	0.55	0.42
C. D. at 5 %	1.39	1.47	0.91	2.08	1.92	1.29
B) Sub plot: Sowing windows						
S_1: 25th MW	23.35^{c}	24.72^{c}	24.03^{c}	34.80^{c}	32.24^{c}	33.52^{c}
S_2: 26th MW	27.25^{a}	28.84^{a}	28.04^{a}	40.60^{a}	37.61^{a}	39.11^{a}
S_3: 27th MW	25.89^{b}	27.27^{b}	26.58^{b}	38.57^{b}	35.41^{b}	36.99^{b}
S_4: 28th MW	20.79^{d}	22.01^{d}	21.40^{d}	30.98^{d}	28.71^{d}	29.85^{d}
S. E.±	0.22	0.23	0.16	0.33	0.3	0.21
C. D. at 5 %	0.64	0.68	0.45	0.95	0.88	0.61
C) Interaction (A×B)						
S_1V_1	23.26^{i}	21.98^{i}	22.62^{i}	30.34^{i}	32.75^{i}	31.55^{i}
S_2V_1	26.86^{e}	25.38^{e}	26.12^{e}	35.04^{e}	37.82^{e}	36.43^{e}
S_3V_1	25.22^{g}	23.83^{g}	24.53^{g}	32.90^{g}	35.51^{g}	34.20^{g}
S_4V_1	20.97^{k}	19.81^{k}	20.39^{k}	27.35^{k}	29.52^{k}	28.44^{k}
S_1V_2	26.24^{f}	24.79^{f}	25.51^{f}	34.22^{f}	36.94^{f}	35.58^{f}
S_2V_2	29.96^{c}	28.30^{c}	29.13^{c}	39.08^{c}	42.17^{c}	40.62^{c}
S_3V_2	28.40^{d}	27.31^{d}	27.86^{d}	36.41^{d}	40.69^{d}	38.55^{d}
S_4V_2	23.91^{h}	22.59^{h}	23.25^{h}	31.19^{h}	33.67^{h}	32.43^{h}
S_1V_3	22.47^{j}	21.23^{j}	21.85^{j}	29.31^{j}	31.64^{j}	30.48^{j}
S_2V_3	26.04^{f}	24.60^{f}	25.32^{f}	33.97^{f}	36.66^{f}	35.31^{f}
S_3V_3	24.94^{g}	23.57^{g}	24.26^{g}	32.54^{g}	35.12^{g}	33.83^{g}
S_4V_3	20.51^{k}	19.37^{k}	19.94^{k}	26.75^{k}	28.87^{k}	27.81^{k}
S_1V_4	26.89^{e}	25.41^{e}	26.15^{e}	35.08^{e}	37.86^{e}	36.47^{e}
S_2V_4	32.49^{a}	30.70^{a}	31.59^{a}	42.38^{a}	45.74^{a}	44.06^{a}
S_3V_4	30.52^{b}	28.84^{b}	29.68^{b}	39.81^{b}	42.97^{b}	41.39^{b}
S_4V_4	22.65^{j}	21.40^{j}	22.02^{j}	29.54^{j}	31.88^{j}	30.71^{j}
S. E.±	0.44	0.46	0.32	0.65	0.61	0.43
C. D. at 5%	1.28	1.36	0.90	1.91	1.77	1.21
General Mean	24.32	25.71	25.01	36.24	33.49	34.87

Note: Observations with same superscript are at par and with different superscript are significantly different.

4. CONCLUSIONS

Amongst all the groundnut varieties, JL-776 (*Phule Bharati*) variety found significantly superior under extended sowing windows followed by varieties RHRG-6083, TAG-24 and JL-501.A sowing window of 26th MW was favourable to maximum pod production because of favourable weather condition. Sowing during 26th MW was observed to be most suitable and optimum for groundnut considering the growth and yield attributes. This sowing window was at par with 27th MW sowing window.

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