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Effect of Sowing Time on Growth, Phenology and Yield Attribute of Summer Groundnut (*Arachis hypogaea* L.)

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A B S T R A C T

An investigation on effect of sowing time on growth, phenology and yield attribute of summer groundnut (*Arachis hypogaea L.*) was conducted at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during summer season of 2012. Twelve treatment combinations with four dates of sowing (01st February, 11th February, 21st February and 02nd March) and three varieties (GG 2, GG 5 and GG 7) were tried in split plot design with four replications. The growth parameters, yield attributes and yield in terms of characters like plant population and test weight were non-significant and the plant height, number of branches, number of pods per plants, number of grains per plant, pod length, grain yield and stover yield were significantly influenced by the dates of sowing. The highest grain yield and stover yield were obtained from the third date of sowing (25th February) and remained statistically at par with fourth date of sowing (5th March). The variety GM 4 gave the highest yield due to more number of pods, number of grains per pod and 100 seed weight, followed by GM 3 variety which remained statistically at par. The duration of crop growth stages were influenced by the sowing dates. The delay in sowing reduced the total duration of the crop maturity period. The weather condition during the crop season was more or less normal and satisfactory.

Introduction

Groundnut (*Arachis hypogaea* L.) is an annual legume crop and a major oilseed of tropical and subtropical countries, which are also known as '*peanut' 'earthnut', 'monkey nut' and 'goobers'*. It is the 13th most important food crop and 4th most important oilseed crop of the world. Groundnut is widely adapted to varying agro-climatic conditions and soils, which has made its cultivation possible in most of the tropical and sub-tropical countries in the world. It is commercially cultivated in about 100 countries located in between 40º N and 40º S latitudes. Groundnut is a C_3 plant where photo-respiration is very high. It is deep and distinct tap roots with secondary and deeply spreading roots, makes it drought resistant to some extent. The dehiscence of the anthers takes place between 5 am and 6 am. Flowers open between 6 am and 8 am. Yield disparity between *rabi* and monsoon groundnut indicate that groundnut required warmth and bright sunshine hours for its

growth and development. Minimum base temperature for the germination is 10^0C, while desirable is 20^0C. Optimum mean air temperature for vegetative growth is 25 to 30^0C. The temperature range for reproductive growth (pegging, pod formation and pod development) is 20 to 26^0C. Flower expression can proceed satisfactory up to a mean air temperature of 33^0C, but pod formation is retarded above 26^0C. The flowering of groundnut does not indicate any thermo periodicity. Higher temperature reduces the duration of the crop. Groundnut is usually, classified as a day neutral plant. Pod yield, however, is affected by day length. Long day (11 to 12 hrs) particularly at the beginning of the crop season, promote vegetative growth and less reproductive growth. In *rabi*, day length remain short during beginning and increase till harvest leading to higher pod yield. Relative humidity should be around 90 per cent in the first month of growth. Relative humidity more than 95 per cent and low temperature of 15^0C for more than 10 hours lead to incidence of leaf spot. Crop production is a function of many variables, of environment, out of which weather is the most important. Among weather variables, temperature and rainfall are the most important factors, which affect the growth, productivity and adaptability of crops (Wallies *et al.,* 1980). The duration of specific stages of growth shows direct relationship with temperature and for particular species, this duration may be predicted through summation of mean daily air temperature (Wang, 1960), because the duration of each growth phase determines the accumulation and partitioning of dry matter in different organs as well as crop responses to external environmental factors. This research is essential for the study of impact of weather parameters during different phases of growth on pod yield of summer groundnut. The information on relationship of weather parameters at different phenophases under irrigated condition will help the scientists and the farmers to increase yield of the crop. Hence, the experiment was proposed to find out the ideal dates of sowing for summer groundnut under the North Gujarat Agro climatic Zone.

Materials and Methods

The experiment was conducted at the Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during summer season of 2012. The soil of experimental plot was loamy sand in texture, low in organic carbon and available nitrogen, medium in available phosphorus and potassium status. Twelve treatment combinations with four dates of sowing (1st February, 11th February, 21st February and 2nd March) and three varieties (GG 2, GG 5 and GG 7) were tried in split plot design with four replications. The keep date of sowing in main plot and varieties as sub plot treatments. The crop was sown in line with spacing of 30 x 10 cm, using seed rate of 100 kg/h and seed treatment with *Rhizobium* and Phosphate Solubilizing bacteria (PSB-10). A recommended dose of nitrogen (25 kg N/ha), phosphorus (50 kg P_2O_5/ha) and sulphur (40 kg S/ha) in form of Urea and DAP and Zinc sulphate for summer groundnut crop was applied as basal dose at the time of bed preparation.

Two interculturing and two hand weeding were carried out in summer groundnut crop to maintain weed free condition during crop season. The crop was free form major insect pests by taking suitable plant protection measures. The five plants from net plot were selected randomly and were tagged in each treatment plots for the purpose of measured observation. The treatments were evaluated on the basis of growth parameters like plant population (plant/m^2), on the basis of yield

attribute like number of pod per plant, pod length measured with measuring scale, number of seed per pod, seed yield and haulm yield measured with weighing balance per net plot and the same was converted to seed yield per hectare. 100 seeds were counted from the sample and their weight (g) was recorded as test weight of each treatment. Phonological observation measured to decide the crop growth stages five plants from net plot were selected randomly and were tagged in each treatment plots for the purpose of identification of phenological stages. Whenever more than three plants from each plot attained a particular stage for consider for that stage. The same was compared with those from each of the experimental plots to generalize the crop growth stages from each date of sowing were recorded as date of emergence, branching, 50 per cent flowering, pod development and pod maturity. The recorded data were subjected to statistical analysis using the analysis of variance technique (Panse and Sukhatme, 1985).

Results and Discussion

Growth parameters

Data pertaining to growth parameters of summer groundnut are presented in Table 1. The data indicated that both initial and final plant population was non-significant.

Yield attributes

Number of pods per plant

The data pertaining to number of pods per plant as influenced due to different dates of sowing and varieties are furnished in Table 2 indicated that number of pods per plant was significantly affected by different dates of sowing. Significantly higher number of pod per plant (18.0) was recorded under third date of sowing D_3 (21st February) followed by second date of sowing D_2 (11th February). Significantly lower number of pods per plant (14.5) was recorded in D_1 sowing (1st February). Sowing on 2nd March (D_4) produced 16.6 per cent higher number of pod per plant over D_1 (1th February) sowing. Effect of varieties on number of pods per plant was significant variations.

Significantly higher number of pods per plant (17.7) was recorded in GG 5 variety (V_2), but it was statistically at par with GG 7 variety (V_3). Significantly the lowest number of pods per plant (15.1) was recorded in V_1 variety (GG 2). Interaction effect of dates of sowing and varieties did not realize significant effect on number of pods per plant. Present results are in accordance with the results reported Naphade *et al.,* (1990) for different varieties of groundnut crop.

100 seed weight (g)

The data on effect of different dates of sowing and varieties on 100 seed weight (g) are presented in Table 2 indicated that 100 seed weight was not influenced due to different dates of sowing. 100 seed weight was significantly affected by different varieties. Significantly higher 100 seed weight (44.5 g) was observed in V_2 variety (GG 5). However, it remained statistically at par with V_3 variety (GG 7). Significantly the lowest 100 seed weight (40.6 g) was recorded in V_1 variety (GG 2). Interaction effect of dates of sowing and varieties was not found non-significant with respect to 100 seed weight.

Shelling per cent

The data pertaining to shelling per cent as influenced due to different dates of sowing and varieties are furnished in Table 2 indicated that shelling per cent was significantly affected by different dates of sowing.

Table.1 Effect of dates of sowing and varieties on initial and final plant (Per meter row length) population in summer groundnut

Treatments	Initial plant population	Final plant population
Main factor - Date of sowing (D)		
D_1 - 1st Feb	8.0	**7.6**
D_2 - 11th Feb	9.0	**8.6**
D_3 - 21st Feb	9.3	**8.9**
D_4 -2nd March	8.4	**8.0**
S.Em.±	0.09	**0.08**
C.D. at 5 %	NS	**NS**
C.V. %	12.3	**12.3**
Sub factor - Varieties (V)		
V_1 - GG 2	8.4	**7.8**
V_2 - GG 5	9.0	**8.7**
V_3 - GG 7	8.7	**8.3**
S.Em.±	0.26	**0.27**
C.D. at 5 %	NS	**NS**
C.V. %	10.7	**11.3**
Interaction (D X V)		
S. Em.±	0.53	**0.54**
C.D. at 5 %	**NS**	**NS**

Table.2 Effect of dates of sowing and varieties on number of pods per Plant, test weight (g), shelling (%) and oil content (%) in summer groundnut

Treatments	Number of pods per plant	Test weight (g)	Shelling (%)	Oil content (%)
Main factor - Date of sowing (D)				
D_1 - 1st Feb	14.5	39.3	61.4	**48.5**
D_2 - 11th Feb	17.3	43.7	67.7	**48.2**
D_3 - 21st Feb	18.0	44.3	71.0	**47.8**
D_4 -2nd March	16.6	42.2	63.7	**47.7**
S.Em.±	0.17	0.32	0.48	**0.06**
C.D. at 5 %	0.60	NS	1.64	**NS**
C.V. %	12.6	9.1	8.7	**1.4**
Sub factor - Varieties (V)				
V_1 - GG 2	15.1	40.6	64.0	**48.2**
V_2 - GG 5	17.7	44.5	67.4	**48.0**
V_3 - GG 7	17.0	42.1	66.4	**47.8**
S.Em.±	0.40	0.91	0.88	**0.17**
C.D. at 5 %	1.21	2.73	2.63	**NS**
C.V. %	8.5	7.5	4.6	**1.3**
Interaction (D X V)				
S.Em.±	0.81	1.83	1.76	**0.35**
C.D. at 5 %	**NS**	**NS**	**NS**	**NS**

Table.3 Effect of date of sowing and varieties on pods yield and haulm yield in summer groundnut

Treatments	Pod yield (kg/ha)	Haulm yield (Kg/ha)
Main factor - Date of sowing (D)		
D_1 - 1st Feb	1043	**1598**
D_2 - 11th Feb	1394	**2073**
D_3 - 21st Feb	1570	**2220**
D_4 -2nd March	1231	**1923**
S.Em.±	12.7	**21.0**
C.D. at 5 %	43.8	**73.0**
C.V. %	11.6	**12.8**
Sub factor - Varieties (V)		
V_1 - GG 2	1250	**1860**
V_2 - GG 5	1378	**2057**
V_3 - GG 7	1301	**1945**
S.Em.±	28.8	**49.4**
C.D. at 5 %	86.0	**148.0**
C.V. %	7.6	**8.8**
Interaction (D X V)		
S.Em.±	57.5	**98.9**
C.D. at 5 %	**NS**	**NS**

Table.4 Influence of sowing date on duration of different phenological Phases (days) of in summer groundnut

Date of Sowing	Phenophases (days)					Total
	P1	**P2**	**P3**	**P4**	**P5**	
D1	10	28	18	18	45	**119**
D2	10	26	16	16	43	**111**
D3	9	25	15	14	42	**105**
D4	7	24	14	14	40	**99**

Significantly higher shelling per cent (71.0) was recorded under third date of sowing (21st February). Significantly lower shelling per cent (61.4) was recorded in first date of sowing (1st February). Effect of varieties on shelling per cent was significant variations. Significantly higher shelling per cent (67.4) was recorded under GG 5 variety (V_2), but it was statistically at par with GG 7 variety (V_3). Significantly the lowest shelling per cent (64.0) was recorded in V_1 variety (GG 2). Interaction effect of dates of sowing and varieties was not found significant with respect to shelling per cent.

Yield

Oil content (%)

The data pertaining to oil content (%) as influenced by different dates of sowing and varieties are furnished in Table 2 indicated

that oil content (%) was non-significantly affected by different dates of sowing. The results indicated that oil content (%) was non-significantly to different varieties. Interaction effect between dates of sowing and varieties on oil content (%) was non-significant.

Pod yield (kg/ha)

The data pertaining to pod yield as influenced due to different dates of sowing and varieties are furnished in Table 3. It is evident that pod yield was significantly influenced due to dates of sowing. Sowing on 21st February (D_3) resulted into significantly higher pod yield (1570 kg/ha), Lower seed yield (1043 kg/ha) was obtained with sowing on 1th February (D_1) followed by the 2nd March (D_4) (1231 kg/ha) and 11th February (D_2) 1394 Kg/ha. The results indicated significant variations on seed yield by different varieties. Significantly higher pod yield (1378 kg/ha) was recorded under GG 5 variety (V_2), but it was statistically at par with GG 7 variety (V_3). Significantly the lowest pod yield (1250 kg/ha) was recorded in V_1 variety (GG 2). This may be due to favourable climatic condition (i.e. temperature, relative humidity, vapour pressure and bright sunshine hours etc.) with less weed competition and has incidence of pest and disease and maximum temperature ranged between 28.5 to 33.0ºC during germination, 27.8 to 38.0ºC during flowering, 35.0 to 40.7ºC during pegging, 34.2 to 40.0ºC during pods development and 36.0 to 41.2ºC during pod maturity while minimum temperature ranged between 9.0 to 12.1ºC during germination, 7.5 to 19.0ºC during flowering, 16.5 to 23.1ºC during pegging, 19.0 to 23.1ºC during pods development and 17.5 to 26.7ºC during pod maturity. Interaction effect of dates of sowing and varieties was non-significant with respect to pod yield. These findings in the present investigation are in accordance with the findings Jadhav *et al.,* (1990)

Haulm yield (kg/ha)

The data pertaining to haulm yield as influenced due to different dates of sowing and varieties are furnished in Table 3 revealed significant variations on haulm yield due to different dates of sowing. Significantly higher haulm yield (2220 kg/ha) was recorded under third date of sowing (21st February). Significantly lower haulm yield (1598 kg/ha) was recorded in first date of sowing (1st February). The results presented in Table 4 indicated significant variations on haulm yield by different varieties. Significantly higher haulm yield (2057 kg/ha) was recorded under GG 5 variety (V_2), but it was statistically at par with GG 7 variety (V_3). Significantly the lowest haulm yield (1860 kg/ha) was recorded in GG 2 variety (V_1). Interaction effect between dates of sowing and varieties on haulm yield was non-significant. These results are in close agreement with the findings of Bhosale *et al.,* (1986) and Jadhav *et al.,* (1994).

Crop phenology

The observation on crop phenological events reflects the influence of weather elements on crop growth and development. In the present study, the occurrence of different phenological events viz., germination, flowering, pegging, pod development, pod maturity were recorded. The phenological calendar for groundnut crop for four dates of sowing in the present investigation is presented in Table 4. Phasic duration at different phenophases of groundnut decreased with delay in sowing from February 1 to March 2. February 1 sown crop took longer duration for maturity (119 days) than the later sown crop in all cultivars due to fulfillment of thermal unit requirements in more days. The days to maturity decreased gradually with the delay in sowings. This may be due to increase in temperature and photothermal environment

encountered by the crop during the growth period. However, reduction in duration (99 days) under fourth date of sowing may be mainly due to expose of the crop to higher maximum temperature (40.4 °C) after flowering.

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