



P-ISSN: 2349-8528

E-ISSN: 2321-4902

www.chemijournal.com

IJCS 2020; 8(3): 340-342

© 2020 IJCS

Received: 17-03-2020

Accepted: 18-04-2020

ML Reager

Assistant Professor, Krishi
Vigyan Kendra, Swami
Keshwanand Rajasthan
Agricultural University, Bikaner,
Rajasthan, India

RC Bairwa

Assistant Professor, Agriculture
Research Station, SKRAU,
Bikaner, Rajasthan, India

AS Godara

Associate Professor, Agriculture
Research Station, SKRAU,
Bikaner, Rajasthan, India

SP Singh

Krishi Vigyan Kendra, Swami
Keshwanand Rajasthan
Agricultural University, Bikaner,
Rajasthan, India

Corresponding Author:**ML Reager**

Assistant Professor, Krishi
Vigyan Kendra, Swami
Keshwanand Rajasthan
Agricultural University, Bikaner,
Rajasthan, India

Phenological performance of groundnut under various sowing environment and planting density in hyper arid zone of Rajasthan, India

ML Reager, RC Bairwa, AS Godara and SP Singh

DOI: <https://doi.org/10.22271/chemi.2020.v8.i3e.9250>

Abstract

An experiment trial was conducted during three consecutive *kharif* seasons of 2017, 2018 and 2019 at three farmer's field and Krishi Vigyan Kendra Farm, Bikaner (Rajasthan) to study the optimum time of sowing and planting density of groundnut. The experiment was laid out in split-plot design with four replications, comprising of nine treatments consisting of three date of sowing (15th May, 30th May and 15th June) as main plot treatments and three planting density (1.67 lac, 2.50 lac and 3.33 lac ha⁻¹) as sub-plots. The results showed that significantly higher crop stand and plant height at harvest was observed in 15th June sowing than all other sowing dates, however, plant height remained at par with sowing at 30th May. Groundnut sown on 30th May recorded significantly higher periodic dry matter production, crop growth rate (CGR) and relative growth rate (RGR) as compared to early sowing on 15th May as well as late sowing on 15th June. Crop stand and plant height increased significantly with each increasing level of planting density (1.67 lac, 2.50 lac, and 3.33 lac ha⁻¹) and the maximum was obtained at plant population of 3.33 lac ha⁻¹. It was also observed that groundnut at planting density of 3.33 lac ha⁻¹ remained statistically at par with planting density of 2.50 lac ha⁻¹ and recorded significantly higher periodic dry matter production, crop growth rate and relative growth rate as compared to planting density of 1.67 lac ha⁻¹.

Keywords: Groundnut, phenological performance, planting density, time of sowing

Introduction

Groundnut (*Arachis hypogaea* L.) is an autogamous, indeterminate, C₃ plant having very high respiration and drought resistant legume. The plant of groundnut has high energy value, rich in nutrients. Groundnut seed contains 44–56% oil and 22–30% protein (Reddy *et al.* 2003), haulm is palatable nutritious feed for cattle, as rich in protein content (10-12%). Groundnut belongs to fabaceae family hence maintains the soil fertility by fixing the atmospheric nitrogen, also acts as efficient cover crop for land exposed to soil erosion. In Rajasthan, the total area under groundnut cultivation was 734556 hectares and total production was 1565452 tonnes with productivity of 2131 kg ha⁻¹ has been reported in the year 2019-20 (Anonymous 2020) [1]. There is wide gap between the actual yield and potential yield which can be bridged to a great extent by introducing the arrangement in treatments like optimum sowing time and planting density to utilize congenial environment in a better way.

Sowing time is an important production component that can be manipulated to minimize the adverse effects of environmental stress. Matching the phenology of the crop to the duration of favourable conditions by selecting the most appropriate sowing dates to avoid the periods of stress is crucial for plant growth. Adjustment of sowing date is very important to optimize climatic environment in respect to growth and phenology of groundnut (Caliskan *et al.* 2008) [3]. Sowing date is also depend on locality and affected largely upon soil temperature, available soil moisture and growing season. In irrigated situation, sowing time is most important nonmonetary inputs affecting crops. In Bikaner region of Rajasthan, the cultivation of groundnut under irrigated conditions was started two decades ago in the command area of canal and later on it spread to tube well irrigated area. At that time, dust storms were common with minimum vegetation, during optimum sowing time of May and June leading to poor crop establishment due to which the farmers started groundnut sowing in early summer in the months of April and May for better crop establishment. This practice is still followed, despite reduction in frequency of dust storms with increase in the irrigated area.

Early sowing of groundnut in the area despite reduction in the frequency of hot winds is fast depleting the water table in the majority of the blocks (SGWB, 2011)^[10] and has considerably reduced WUE (Water use efficiency) of canal command area. In India groundnut is sown in the rainy season with the onset of rains in May to June.

Use of low plant population is responsible for low yields in groundnut as much as 150 – 250 % increase in pod yield can be realized by higher population densities and applying better management. The objective of plant population studies in crop plants is to determine the optimum plant population density for maximum productivity (Mukhtar *et al.* 2013)^[8]. Growing of groundnut in *kharif* is gaining importance in Hyper Arid Zone of Rajasthan. Due to lack of recommendation of suitable time of sowing and standardization of optimum plant population, the farmers are using heavy seed rate up to 240 kg ha⁻¹ even though it is a costly input in groundnut cultivation. Optimum plant population ha⁻¹ in a sowing time at specific situation reduces the cost of cultivation and enhanced yield potential of the crop. Keeping all these facts under consideration the present study was undertaken to standardize the optimum sowing time and plant density.

Materials and methods

A field experiment was conducted during three consecutive *kharif* seasons of 2017, 2018 and 2019 at three farmers' field and instructional farm of Krishi Vigyan Kendra, Bikaner (Rajasthan) under hyper arid condition, which is situated at 28° 01'N latitude, 73 ° 22' E longitudes and at an altitude of 234.70 meters above mean sea level. The soil of the experimental site was loamy sand and having 258.67 kg ha⁻¹ N, 17.42 kg ha⁻¹ available P, 223.4 kg ha⁻¹ K and 0.79 % organic carbon. The pH of soil was 8.3 (1:2.5 soil and water ratio). Field capacity, permanent wilting point and bulk density recorded were 3.0% (w/w), 1.83% (w/w) and 1.67 Mg m³, respectively in 0-30 cm soil depth. The experiment was laid out in split-plot design with four replications (Each farmers field and farm being one replication), assigning nine treatments consisting of three date of sowing (15th May, 30th May and 15th June) as main plot and three planting density (1.67 lac ha⁻¹, 2.50 lac ha⁻¹ and 3.33 lac ha⁻¹) as sub-plots. Sowing of groundnut variety HNG-69 was done as per the time of sowing treatment at different planting density (having seed rate of 80 kg, 120 kg and 160 kg ha⁻¹, in respective treatments of 1.67 lac, 2.50 lac and 3.33 lac ha⁻¹). The recommended doses of nitrogen (20 kg N ha⁻¹) and phosphorus (40 kg P₂O₅ ha⁻¹) fertilizers were applied as basal. Urea and single super phosphate were used as source for supplying N and P₂O₅ nutrients respectively. Besides time of sowing and plant density, the crop was raised with recommended package of practices. The phenological observations were recorded at 30, 60, 90, 120 DAS and at harvest from per half meter row length from each plot and CGR & RGR were computed using standard formulae. The data obtained were statistically analyzed accord with the Split Plot Design. Analysis of variance was used to test the significance of treatment effects at 5 percent level of probability. Least Significant Difference (LSD) Test was used to compare treatment means of pool of three years.

Results and discussion

Effects of sowing dates

The results of the study showed that significantly higher crop stand at harvest was observed in 15th June sowing than all

other sowing dates (Table 1). This may be due to harsh weather in terms of higher temperature, low relative humidity, low rainfall, higher evaporation and wind velocity in the month of May experienced by the early sown crop which lead to poor crop establishment as evident from poor plant stand recorded under these sowing dates. Sowing of groundnut at 15th June remained statistically at par with sowing at 30th May, recorded significantly taller plant at harvest stage than sowing at 15th May (Table 1). This increase may be due to the favourable effect on crop is usually planted after the first effective rains or as soon as soil moisture is conductive (Meena and Yadav, 2014)^[6].

However, results also showed that groundnut sown on 30th May recorded significantly higher periodic dry matter production, crop growth rate (CGR) and relative growth rate (RGR) as compared to early sowing on 15th May as well as late sowing on 15th June (Table 1 & 2). Groundnut sown on 30th May, increased the dry matter production with the tune of 0.80 and 1.27 per cent at 30 DAS, 1.45 and 2.32 per cent at 60 DAS, 2.33 and 3.76 per cent at 90 DAS, 3.35 and 5.43 per cent at 120 DAS and 2.63 and 4.24 per cent at harvest as compared to sown at 15th May and 15 June, respectively. The higher dry matter recorded in sowing at 30th May could be mainly attributed to the similar crop growth and relative growth rates recorded of the crop. This might be due to favourable environmental condition for optimum growth of plants. The results of this investigation are in close conformity with the findings of (Gosh, 2005 and Meena *et al.*, 2014)^[4, 6]; they reported higher values of growth parameters in last week of May sown groundnut with progressive reduction with each delaying in sowing.

Effects of planting density

Plant stand at harvest remained significantly with planting density treatment. planting density of 3.33 lac ha⁻¹ recorded significantly higher plant stand over all lower planting density (Table 1). Plant height increased significantly with each successive increasing level of planting density (1.67, 2.50, and 3.33 lac ha⁻¹) and the maximum was obtained at plant population of 3.33 lac ha⁻¹ (Table 1). The higher plant density might have resulted in mutual shading of the plants with increased competition by crops to intercept radiation and forced the plants to increasing inter nodal length in search of light and increase stem growth at the expense of assimilate partitioning to reproductive tissue. Similar findings were reported by Rama Jyothi *et al.* (2004)^[9] and Mukhtar *et al.* (2013)^[8].

Results also showed that groundnut at planting density of 3.33 lac ha⁻¹ recorded significantly higher periodic dry matter production, crop growth rate and relative growth rate as compared to planting density of 1.67 lac ha⁻¹ (Table 1 & 2), however, it remained at par with planting density of 2.50 lac ha⁻¹ with respect to all these phenological parameters. Planting density of 3.33 lac ha⁻¹ increased dry matter production to the tune of 3.45 per cent at 30 DAS, 6.41 per cent at 60 DAS, 10.55 per cent at 90 DAS, 15.58 per cent at 120 DAS and 11.98 per cent at harvest, crop growth rate 3.42 per cent during 0-30 DAS, 8.26 per cent during 30-60 DAS, 15.61 per cent during 60-90 DAS and 30.01 per cent during 90-120 DAS and relative growth rate 0.77 per cent during 30-60 DAS, 1.19 per cent during 60-90 DAS, 1.62 per cent during 90-120 DAS and 1.22 per cent during 120 DAS to harvest as compared to Planting density of 1.67 lac ha⁻¹. The dry matter production per unit area, crop growth rate and relative growth rate followed the same trend as that of the

plant height, due to more number of plants per unit area that resulted in higher dry matter production. The higher crop growth rate and relative growth rate might be due to increased height which increased competition for intercept radiation and forced the plants to increasing inter nodal length and stem

growth at the expense of assimilate partitioning to reproductive tissue. The findings conform to the work reported by Kathirvelan and Kalaiselvan (2006)^[5] and Bhagavatha Priya *et al.* (2016)^[2].

Table 1: Effect of different date of sowing and planting density on growth attributes of groundnut (pooled 2017-2019)

Treatments	Plant density at harvest (000)	Plant height at harvest (cm)	Dry matter accumulation (kg ha ⁻¹)				
			30 DAS	60 DAS	90 DAS	120 DAS	Harvest
Date of sowing							
Sowing at 15 May	193.40	38.44	1252.27	3349.78	6249.33	8664.17	9248.88
Sowing at 30 May	213.99	40.25	1262.23	3398.38	6395.13	8954.41	9491.89
Sowing at 15 June	222.76	40.37	1246.42	3321.21	6163.64	8493.60	9106.07
SEm±	1.99	0.50	3.29	16.09	48.26	96.06	80.43
CD at 5%	5.91	1.49	9.79	47.79	143.37	285.41	238.96
Planting density							
1.67 lac ha ⁻¹	142.86	35.70	1227.00	3226.38	5879.13	7927.24	8631.89
2.50 lac ha ⁻¹	214.86	39.44	1264.58	3409.84	6429.52	9022.87	9549.21
3.33 lac ha ⁻¹	272.42	43.92	1269.35	3433.15	6499.45	9162.07	9665.75
SEm±	1.64	0.43	2.79	13.64	40.92	81.46	68.21
CD at 5%	4.65	1.21	7.92	38.68	116.03	230.98	193.39

Table 2: Effect of different date of sowing and planting density on CGR and RGR of groundnut (pooled 2017-2019)

Treatments	CGR (g m ² day ⁻¹)					RGR (mg g ⁻¹ day ⁻¹)			
	0-30 DAS	30-60 DAS	60-90 DAS	90-120 DAS	120 DAS to harvest	30-60 DAS	60-90 DAS	90-120 DAS	120 DAS to harvest
Date of sowing									
Sowing at 15 May	4.17	6.99	9.67	8.05	1.95	11.75	12.65	13.11	13.21
Sowing at 30 May	4.21	7.12	9.99	8.53	1.79	11.77	12.68	13.17	13.25
Sowing at 15 June	4.15	6.92	9.47	7.77	2.04	11.74	12.63	13.09	13.19
SEm±	0.01	0.04	0.11	0.16	0.05	0.01	0.01	0.02	0.01
CD at 5%	0.03	0.13	0.32	0.47	0.15	0.02	0.03	0.05	0.04
Planting density									
1.67 lac ha ⁻¹	4.09	6.66	8.84	6.83	2.35	11.69	12.56	12.99	13.12
2.50 lac ha ⁻¹	4.22	7.15	10.07	8.64	1.75	11.77	12.69	13.18	13.27
3.33 lac ha ⁻¹	4.23	7.21	10.22	8.88	1.68	11.78	12.71	13.20	13.28
SEm±	0.01	0.04	0.09	0.14	0.04	0.01	0.01	0.01	0.01
CD at 5%	0.03	0.10	0.26	0.38	0.13	0.02	0.03	0.04	0.03

References

- Anonymous. Crop-wise Area, Production and Yield of various principal crops Second Advance Estimates of Kharif 2019 & First Advance Estimates of Rabi 2019-20. Commissionerate of Agriculture, Rajasthan-Jaipur, 2020.
- Bhagavatha Priya T, Subramanyam D, Sumathi V, Naidu MVS. Growth Characters and Yield of Early Kharif Groundnut As Influenced By Varieties and Plant Populations. IOSR Journal of Agriculture and Veterinary Science. 2016; 9(5):81-83.
- Caliskan S, Caliskan ME, Arslan M, Arioglu H. Effects of sowing date and growth duration on growth and yield of groundnut in a Mediterranean-type environment in Turkey. Field Crops Res. 2008; 105(1-2):131-40.
- Gosh PK. Optimization of date of sowing in new groundnut-wheat relay cropping system in semi-arid tropics of India. Journal of Sustainable Agriculture. 2005; 26(3):1044-1046.
- Kathirvelan P, Kalaiselvan P. Growth characters, physiological parameters, yield attributes and yield as influenced by the confectionary groundnut varieties and plant population. Research Journal of Agriculture and Biological Sciences. 2006; 2(6):287-291.
- Meena RS, Yadav RS, Meena VS. Response of groundnut (*Arachis hypogaea* L.) varieties to sowing dates and NP fertilizers under western dry zone of India. Bangladesh Journal of Botany. 2014; 43(2):169-173.
- Meena RS, Yadav RS. Phenological performance of groundnut varieties under sowing environments in hyper arid zone of Rajasthan, India. Journal of Applied and Natural Science. 2014; 6(2):344-348.
- Mukhtar AA, Tanimu B, Ibrahim S, Mohammad AA, Jaliya MM. Growth and development of three groundnut (*Arachis hypogaea* L.) varieties as affected by basin size and plant population at kadawa, sudan savanna nigeria. International Journal of Advanced Biological Research. 2013; 3(3):336-340
- Rama Jyothi M, Radha Kumari C, Obulamma U, Lingam B. Response of early rabi groundnut, (*Arachis hypogaea* L.) to spacing, irrigation and plant protection levels. Journal of Oilseeds Research. 2004. 21(1):171-172.
- SGWB. State Ground Water Board. State Groundwater Board office, Bikaner. Survey report, 2011, 13-19.