International Journal of Agriculture Sciences
ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 10, Issue 22, 2018, pp.-7518-7521.
Available online at https://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000217

Research Article

PERFORMANCE OF GROUNDNUT (COGN 4) CROP INFLUENCE ON DATES OF SOWING AND NITROGEN LEVELS, GROWTH AND YIELD OF IRRIGATED CONDITION UNDER CHANGING CLIMATE IN SOUTHERN AGRO-CLIMATIC ZONES OF TAMIL NADU

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Received: November 09, 2018; Revised: November 26, 2018; Accepted: November 27, 2018; Published: November 30, 2018

Abstract: Study was conducted at the Agricultural College and Research Institute, Madurai to find out the influence on dates of sowing and nitrogen levels on the growth and yield of groundnut cultivars COGn 4 during *Rabi* crop season 2016. Twelve treatment combinations comprising off our dates of sowing (D1:9th February, D2:19th February, D3: 29th February, and 9th D4:March) and three N levels (Normal dose, 25% more, 25% less) was executed in factorial randomized block design with three replications. The growth parameters like plant height, dry matter production and leaf area index and yield of parameters like pod yield and haulm yield were significantly influenced by the dates of sowing. The highest pod yield and haulm yield were obtained from the plants sown during February 9th, followed by February 19th sowing. The variety COGn 4 recorded the highest pod yield and haulm yield. Delay in sowing reduced the crop duration and subsequently reduced the crop yield. Results of N levels highest influenced were significantly higher growth and yield parameters were influenced by N_3: Higher than normal and followed by N_1: Normal and lower on nitrogen levels was observed in N_2: Lesser than normal. Interaction between dates of sowing and nitrogen levels influenced highest growth and yield parameters significantly were D_1: 9th February+ N_3: Higher than normal followed by D_1:9th February+ N_1:Normal and lowest interaction was observed by D_1:9th February+N_2: Lesser than normal.

Keywords: Groundnut, Climate change, Sowing date, Nitrogen levels, Productivity

Citation: Vijayakumar M. and Geethalakshmi V. (2018) Performance of Groundnut (CoGn 4) Crop Influence on Dates of Sowing and Nitrogen Levels, Growth and Yield of Irrigated Condition under Changing Climate in Southern Agro-Climatic Zones of Tamil Nadu. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 10, Issue 22, pp.- 7518-7521.

Introduction

Groundnut crop is a C3 leguminous oilseed crop grown in during Kharif and *Rabi* season and it can be successfully grown drought prone area, during summer it requires irrigation. In India, groundnut is cultivated in an area of 45.9 lakh hectare with the total production of 67.3 lakh tonnes and productivity of 1465 kg ha^{-1}, respectively. Seventy percent of the area and 75 percent of the production is the states of Gujarat, Andhra Pradesh, Tamil Nadu and Karnataka. In Tamil Nadu, it is cultivated in area of 3.46 lakh hectare with production of 8.92 lakh tonnes and productivity of 2574 kg ha^{-1} respectively, during 2015-16 [1,2]. It's mainly depends on a number of factors; however, climate plays the most important role. Among the climatic parameter's role of solar radiation, temperature, humidity, rainfall is very crucial. The oilseed crops, particularly groundnut is very sensitive to climatic parameters such as radiation and temperature. Kataria and Pandya (1995) [3] reported that the December and January sown crops showed greater efficiency of partitioning of recent assimilates to the pods. The summer groundnut crop can be sown as early as possible in December/January to get higher yields. Reddy and Reddy (2001) [5] reported that pod yield of groundnut was positively correlated with the total number of flowers produced per plant, number of flowers per plant produced during the first four weeks, number of pegs and pods per plant and hundred kernel weight. The late sown crop mature earlier, resulting in a reduced pod number and 100-kernel weight. Reddy and Suresh (2000) reported that plant height and leaf area index increased in the late sown crop, while dry matter accumulation at harvest was maximum, when the crop was sown in January. The present study was undertaken to identify optimum date of sowing and N level for two ruling cultivars of groundnut for maximizing the productivity under changing climatic conditions.

Materials and Methods

The experiment was conducted at the Agricultural College and Research Institute, Madurai, during *Rabi* crop season 2016. The soil of the experiment field was sandy clay loam with low in available nitrogen 247 kg ha^{-1} Subbiah and Asija (1956) [6], medium in phosphorus (18.1 kg ha^{-1}) (Olsen *et al* (1954) [4], potassium 362 kg ha^{-1} Stanford and English [7] and organic carbon (0.48) Walkely and Black, (1934) [10].Twelve treatment combinations with four dates of sowing D1: February 9th, D2: February 19th, D3: February 29th, and D4: March 9th and three N levels were tried in factorial randomized block design with three replications in D1: 9th February+N: Normal the variety of COGn 4. The crop was sown with a spacing of 30 x 10 cm, recommended fertilizer dose of 25 $kgha^{-1}$ N,50 kg ha^{-1} P_2O_5 and 75 kg ha^{-1} K_2O was followed. Nitrogen alone was applied as per the treatment (N_1-54.25 kg ha^{-1}, N_2-40.76 kg ha^{-1} and N_3-67.93kg ha^{-1}). Intercultural operations were to maintain the field under weed free condition during crop season. Suitable plant protection measures were followed to keep the crop free form major insect pests. Five plants were selected randomly and tagged in each treatment plots for the measured observation. The treatments were evaluated on the basis of growth parameters and yield parameters and were converted to per hectare for presenting the results.

Results

Phenology of Groundnut

The data on the mean phenology of groundnut *viz*., days to 50 % flowering, days to pod initiation and days to maturity are presented in [Table-1]. Different dates of sowing and nitrogen levels exerted significant influence on all the three parameters.

Table-1 Effects of dates of sowing and nitrogen levels on phenology of Groundnut

Treatments	Days to 50% flowering	Days to pod initiation	Days to maturity
Dates of Sowing (D)			
D_1: 9th February	36	70	117
D_2:19th February	33	65	116
D_3:29th February	30	62	115
D_4:9th March	28	58	112
Nitrogen levels (N)			
N_1: Normal (100%)	32	65	115
N_2: Lesser than normal (-25%)	31	62	114
N_3: Higher than normal (+25%)	33	65	116
SEd (D)	0.44	0.95	1.53
CD (0.05) (D)	0.92	1.96	3.18
SEd (N)	0.38	0.82	NS
CD (0.05) (N)	0.80	1.70	
SEd (Dx N)	NS	NS	NS
CD (0.05) (D x N)			

Days to 50% flowering

The mean number days to 50 % flowering significantly differed by various sowing dates. The days to 50 % flowering was observed on 36th day, in D1:9th February sown crop, while it got delayed by 3,6 and 8 days when the sowing was delayed to D2:19th February (33days) and D3:29th February (30days) and D4:9th March (28days) respectively. With respect to N levels, the recommended dose of N application (N_3:higher than normal) recorded 50% flowering on 33rdday after sowing. When the N level was reduced 25% by (N_1: Normal), it got delayed by one day and if the N level is reduced by 25% (N_2: lesser than normal), the days to 50% flowering for delayed by 3 days from the recommended level of N application. The interaction between dates of sowing and N levels with respect to days to 50% flowering is not statistically significant.

Days to pod initiation

The mean number days to pod initiation significantly differed by various sowing dates. The days to pod initiation was observed on 70th day, in D1:9th February sown crop, while it got delayed by,5,8 and 12 days, when the sowing was delayed to D2:19th February (65days), D3:29th February (62days) and D4:9th March (58 days) respectively. With respect to N levels, the recommended dose of N application (N_3:Higher than normal) recorded days to pod initiation on 66th day after sowing. When the N level was reduced by 25% (N1), it got reduced by 1 day and if the N level is 25% reduced by (N_2) the days to pod initiation for reduced by 2 days from the recommended level of N application. The interaction between dates of sowing and N levels with respect to days to pod initiation is not statistically significant.

Days to maturity

The mean number days to maturity significantly differed by various sowing dates. For The days to maturity was observed on 117days, in D1:9th February sown crop, while it got delayed by 1,2 and 5 days when the sowing was delayed to D2:19th February (116days) and D3:29th February (115days) and D4:9th March (112days) respectively. With respect to N levels, the recommended dose of N application recorded days to maturity on 116thdays after sowing and N level was enhanced by 25% (N_3), it got delayed by 1 day and if the N level is recommended dose by (N_1), the days to maturity for reduced by 25% from the recommended level of N_2 application. The interaction between dates of sowing and N levels with respect to days to maturity is not statistically significant.

Growth parameters

The observation on growth parameters like plant height, dry matter production and leaf area index as influenced by different dates of sowing were recorded when groundnut repute forwards crop duration. The data were presented in [Table-2].

Table-2 Effects of dates of sowing and nitrogen levels on growth parameters of Groundnut

Treatments	Plant height (cm) 60DAS	Dry matter production (Kg/ha) 60DAS	Leaf area index (cm) 60DAS
Dates of Sowing (D)			
D_1: 9th February	34.88	9056.19	4.02
D_2:19th February	31.84	8217.15	3.98
D_3:29th February	26.87	7062.02	3.66
D_4:9th March	24.11	5329.21	3.56
Nitrogen levels (N)			
N_1: Normal (100%)	29.69	7379.33	3.66
N_2: Lesser than normal (-25%)	27.38	7087.78	3.23
N_3: Higher than normal (+25%)	31.21	7781.32	4.52
SEd (D)	34.88	121.31	0.06
CD (0.05) (D)	31.84	251.60	0.12
SEd (N)	0.63	105.06	0.05
CD (0.05) (N)	1.30	217.89	0.11
SEd (Dx N)	1.25	210.12	0.10
CD (0.05) (D x N)	2.59	435.78	0.21

Table-3 Effects of dates of sowing and nitrogen levels on yield attributing characters and yield

Treatments	Number of matured pods / plant^{-1}	Shelling percent (%)	100 seed weight (g)	Pod yield (kgha^{-1})	Haulms yield (kgha^{-1})
Dates of Sowing (D)					
D_1: 9th February	28.04	87.45	68.30	1980.77	4998.97
D_2:19th February	23.57	80.94	69.23	1946.44	4838.13
D_3:29thFebruary	22.29	86.60	65.22	1865.11	4537.77
D_4:9th March	19.71	91.20	60.54	1629.70	4434.59
Nitrogen levels (N)					
N_1: Normal (100%)	23.33	86.70	65.25	1949.40	4826.12
N_2: Lesser than normal (-25%)	22.03	87.80	63.53	1530.08	3925.38
N_3: Higher than normal (+25%)	24.84	85.14	68.69	2087.03	5355.59
SEd (D)	0.64	1.24	1.79	45.36	110.73
CD (0.05) (D)	1.32	2.58	3.71	94.08	229.66
SEd (N)	0.55	NS	1.55	39.28	95.90
CD (0.05) (N)	1.14		3.21	81.48	198.89
SEd (Dx N)	1.10	2.16	3.10	78.57	191.79
CD (0.05) (D x N)	2.29	4.47	6.42	162.95	397.78

Plant height

The mean number of plant height 60DAS significantly differed by various sowing dates. The highest plant height was observed on 34.8, when it sowing dates on D1:9th February sown crop, while it got delayed 10 days interval on 31.8, 26.8 when it sowing dates on D2:19th February and D3:29th February and lowest plant height was observed by 24.1 when it sowing the dates on D4:9th March. With respect to N levels, the recommended dose of N application recorded highest plant height was 31.2 followed by enhanced by 25% (N_3), followed by recommended dose by (N_1), and lowest plant height was observed on reduced by 25% on plant height from the recommended level N_2 application. The interaction between dates of sowing and N levels with respect to plant height was statistically significant.

Dry matter production

The mean number of dry matter production 60DAS significantly differed by various sowing dates. The highest dry matter production was observed on 9056.1 kg ha^{-1} in D1:9th February sown crop, while it followed by 10 days interval delayed on 8217.1 kg ha^{-1} and 7062.2 kg ha^{-1}, when it sowing dates on D2:19th February and D3:29th February and the lowest dry matter production was observed by 5329.2 kg ha^{-1} when it sowing dates on D4:9th March. With respect to N levels, the N application recorded highest dry matter production was 7781.315 kg ha^{-1} enhanced by 25% (N_3) followed by the from recommended dose by (N_1), and lowest plant height was observed on reduced by 25% (N_2) on dry matter production from the recommended level N application. The interaction between dates of sowing and N levels with respect to dry matter production was statistically significant.

Leaf area index

The mean number of leaf area index 60DAS significantly differed by various sowing dates. The highest leaf area index was observed on 4.0 on par with 3.9, when it was sowing dates on D2:19th February and lowest date sowing was observed by 3.6 on par with 3.5, when the sowing the dates D3:29th February on D4:9th March. With respect to the N levels application of N_3 recorded highest leaf area index was observed on4.5 followed by 3.66 when it was application of N_1. The lowest N levels was observed in 3.2, when it application of N_2. The interaction between dates of sowing and N levels with respect to dry matter production was statistically significant.

Yield and Yield attributes

Number of matured pods / plant^{-1}

The observation on number of matured pods/plant^{-1},shelling percent(%),100 seed weight(g),Pod yield(kgha^{-1}),Haulms yield (kgha^{-1}) as influenced by different dates of sowing were recorded when groundnut repute forwards crop duration. The datas were presented in [Table-3].

The mean number of matured pods/plant^{-1} significantly differed by various sowing dates. The highest number of matured pods/plant^{-1} was observed on 28.04 when it sowing dates on D1: 9th February and followed by 23.57 and followed by 22.29 when it sowing dates on D2: 19th February and D3:29th February. The lowest number of matured pods/plant was observed by 19.71 the sowing dates on D4:9th March. With respect to the N levels application of N_3 recorded highest number of matured parts was observed on 24.84 followed by 23.3, when it was application of N_1. The lowest number of matured pods/plant was observed by 22.03, when it application of N_2. The interaction between dates of sowing and N levels with respect to number of matured pods/plant^{-1} was statistically significant.

Shelling percent (%)

The mean of shelling percent significantly differed by various sowing dates. The highest shelling percent was observed on 91.20 when it was sowing dates on D4:9th March followed by 87.45 and 86.60 when the sowing dates on D1: 9th February and D3: 29th February. The lowest shelling percent was observed by 80.94 the sowing dates D2:19th February. With respect to the N levels of application was not statistically significant. The interaction between dates of sowing and N levels with respect to shelling percent was statistically significant.

Hundred seed weight (g)

The mean of hundred seed weight significantly differed by various sowing dates. The highest100 seed weight was observed on 68.30 on par with 69.23when it was sowing dates on D1:9th February and D2: 19th February and followed by 65.22 the date of sowing D3:29th February. The lowest 100 seed weight was observed by 60.54 when it sowing dates on D4:9th March. With respect to the N levels application of extended 25% of N_3 was highest 100 seed weight observed in 68.69 followed by 65.25 recommended level N_1. The lowest 100 seed weight was observed on 63.53 reduced levels of 25% of N_2. The interaction between dates of sowing and N levels with respect to 100 seed weight was statistically significant.

Pod yield (Kgha^{-1})

The mean of pod yield significantly differed by various sowing dates. The highest pod yield was observed on 1980.7 on par with 1946.4, when it sowing dates on D1:9th February and followed by 1865.1 the date of sowing D3:29th February. The lowest pod yield was observed by 1629.7sowing dates on D4:9th March. With respect to the N levels application of extended 25% of N_3 was highest observed in 2087.0 followed by 1949 recommended level N_1. The lowest pod yield was observed on 1530.0 on reduced 25% of N_2. The interaction between dates of sowing and N levels with respect to pod yield was statistically significant.

Haulm yield (Kgha^{-1})

The mean haulm yield significantly differed by various sowing dates. The highest haulm yield was observed on 4998.9 on par with 4838.1 when it was sowing dates on D1:9th February and D2:19th February. The lowest haulm yield was observed by 4537.7 and 4434.5, when the sowing dates on D3:29th February and D4:9th March. With respect to the N levels application of extended 25% of N_3 was highest observed in 5355.5 followed by 4826.1 recommended levels of N_1. The lowest pod yield was observed on 3925.3 on 25% reduced levels of N_2. The interaction between dates of sowing and N levels with respect to haulm yield was statistically significant.

Discussion

Prasad, *et al*. (2000) [1] who associated variation in fruit number to both the timing and the initial rate of flower production. These results from phenology of groundnut during crop duration Also, the differences in flowering pattern and days to 50% flowering demonstrate variation in flowers and flowering among the groundnut varieties and subsequently maximum pod maturity. Shwetha *et al*., (2017) [9] reported that growth parameters *viz*., plant height, dry matter production and leaf area index increased in the changing climate associated with treatments as compared to the dates of sowing. These results observed that the growth has increased in the plant height and dry matter production and leaf area index which may be influenced by to the factors that the carbon dioxide has enhance the crop growth. Sahu *et al*.,(2004) [8] reported that yield and yield attributes of groundnut during rainy season were significantly influenced by times of sowing. Varieties did not exert significant influence on yield and yield attributes of groundnut. Due to changing weather variables, different sowing times altered the yield and yield components significantly except shelling percentage. Many of earlier studies are in line with the present findings which reported that groundnut being a C3 plant, respond positively to temperature showed increase in photosynthetic rate, biomass, increased plant height, root length, shoot length, stem length, leaf area and total biomass compared to the CO_2 condition.

Conclusion

These results were concluded that solution to improve dates of sowing and different nitrogen levels to enhance the growth and yield to increase crop production and productivity while enhancing growth and yield and protecting environmental quality. The present study shows that dates of sowing and different nitrogen treatments were recorded highest growth and yield parameters D1 sowing and N_3 nitrogen levels of our indicate the *Rabi* season in the irrigated condition at the southern districts. The days to maturity decreased gradually with the delay in sowings. This may be due to increase in temperature and photo thermal environment encountered by the crop during the growth period.

However, reduction in duration under fourth date sowing may be mainly due to exposed to higher maximum temperature (45.2°C) at flowering stage in experimental field.

Application of research: Study shows crop influence under changing climate in southern agro-climatic zones of Tamil Nadu

Research Category: Agronomy

Acknowledgement / Funding: Authors are thankful to Agricultural College and Research Institute, Madurai, 625 104, Tamil Nadu Agricultural University, Coimbatore, 641003, India

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Research project name or number: PhD Thesis

Author Contributions: All authors equally contributed

Author statement: All authors read, reviewed, agreed and approved the final manuscript

Conflict of Interest: None declared

Sample Collection: Sample seeds were collected from Agricultural College and Research Institute, Madurai, Tamil Nadu Agricultural University, Coimbatore, 641003, Tamil Nadu.

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

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