International Journal of Plant & Soil Science

33(6): 41-45, 2021; Article no.IJPSS.67334
ISSN: 2320-7035

Effect of Irrigation Levels and Intervals on Groundnut (*Arachis hypogaea* L.) Cultivars under Drip System

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2021/v33i630442
Editor(s):
(1) Dr. Muhammad Shehzad, The University of Poonch Rawalakot AJK, Pakistan.
Reviewers:
(1) U. Triveni, Acharya N.G.Ranga Agricultural University, India.
(2) Dirceu Guilherme de Souza Ramos, Federal University of Jataí, Brazil.
Complete Peer review History: http://www.sdiarticle4.com/review-history/67334

Original Research Article

Received 12 February 2021
Accepted 19 April 2021
Published 27 April 2021

ABSTRACT

The field experiment entitled "effect of irrigation levels and intervals on groundnut (*Arachis hypogaea* L.) Cultivars under drip system" was conducted at Instructional Farm, S.K. Rajasthan Agricultural University, Bikaner during *Kharif* 2019. Irrigation level of 0.80 PE gave higher dry matter accumulation, pods plant^{-1} (44.13), kernels pod^{-1} (2.38), pod yield (3117 kg ha^{-1}), haulm yield (4081 kg ha^{-1}), biological yield (7199 kg ha^{-1}), test weight (446.58 g) and oil yield (978.32 kg ha^{-1}) followed by 0.60 PE. Alternate day irrigation intervals gave higher dry matter accumulation, crop growth rate, pods plant^{-1} (43.55), kernels pod^{-1} (2.36), pod yield (2993 kg ha^{-1}), haulm yield (3986 kg ha^{-1}), biological yield (6980 kg ha^{-1}), test weight (443.22 g) compared to 3 days irrigation intervals. Groundnut cultivars HNG-123 gave higher pods plant^{-1} (43.45), kernel pod^{-1} (2.39), pod yield (2925 kg ha^{-1}), haulm yield (3977 kg ha^{-1}), biological yield (6902 kg ha^{-1}) and test weight (470.58 g) compared to all other cultivars.

Keywords: Irrigation; pod; haulm; yield and potential evapotranspiration.

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1. INTRODUCTION

Oilseeds occupy an important place in Indian economy and contribute about 6 per cent to the gross national product and 9 per cent of the value of all agricultural commodities. Groundnut (*Arachis hypogaea L.*) is an annual legume as well as oilseed crop and is a member of the sub–family Papilionaceae of the family Leguminaceae. Groundnut seed (kernel) contains 44–50 per cent oil, 44-56 per cent fat, 26 per cent protein and 10-20 per cent carbohydrate. The country ranks second in the groundnut production and Gujarat ranks first in India. Groundnut occupies first position among all oilseeds with regard to area and production in India. Though, India has the largest irrigated area in the world; the coverage of irrigation is only about 40 per cent of the gross cropped area. Reasons for the low coverage of irrigation are the use of flood (conventional) method of irrigation, where water use efficiency is very low. Drip irrigation system is one of the advanced methods of irrigation. The system is popular in arid and semi arid regions having high evaporation losses. Frequency of irrigations and the volume of irrigation water approaching the consumptive use of plants in drip system will minimize the conventional losses and in turn improve the water use efficiency. Drip irrigation can save water up to 40 to 70 per cent as well as increasing the crop production to the extent of 20 to 100 per cent (Reddy and Reddy, 2003). Adoption of drip irrigation only reduce irrigation water requirement but also improve yield by maintaining moisture content in the *rhizosphere* at field capacity throughout the growing season. Thus drip irrigation becomes prerogative for increasing the yield of even close growing crop like groundnut, which significantly increase efficiency of water and fertilizer through minimizing losses of water and nutrient, supplying nutrients directly to root zone in available forms and reducing cost of fertilizer application compared to traditional fertilizer application [1]. Further there is a need to evaluate cultivars under dip system. Keeping all those in view this experiment has been framed.

2. MATERIALS AND METHODS

\The field experiment was conducted at Instructional Farm, S.K. Rajasthan Agricultural University, Bikaner during *Kharif* 2019. Bikaner is situated at 28.01^{o}N latitude and 73.22^{o}E longitude at an altitude of 234.70 meters above mean sea level. Bikaner falls under Agro-ecological region No. 2 (MgE1) in arid ecosystem (Hot arid eco-region with desert and saline soil), which is characterized by deep, sandy and coarse loamy, desert soils with low water holding capacity and hot and arid climate. The soil of experimental unit was poor in organic carbon (0.10%) having available nitrogen of 86.4 kg/ha, phosphorus of 33 kg/ha, potassium of 331 kg/ha. Electrical Conductivity (1:2) of the soil was 0.2 dS per m with pH 8.4. The treatment comprised of irrigation levels viz., 0.60 Potential evaporation (PE) and 0.80 PE and two irrigation intervals viz., alternate and 3 days assigned to main plot and three groundnut cultivars viz., HNG-69, HNG-123 and TG-37-A in sub plot. The experiment was laid out in split plot design and replicated thrice.

3. RESULTS AND DISCUSSION

3.1Growth Attributes

Irrigation levels did not influence plant stand at 30 DAS and harvest. Irrigation level at 0.80 PE recorded highest dry matter accumulation per plant (9.98, 26.14 and 47.72 g plant^{-1} at 40DAS, 80 DAS and at harvest respectively) as compared to 0.60 PE. Low dry matter accumulation plant^{-1} at 0.60 PE was mainly due to low water supply under scorching temperature during hot summer months. This was in confirmation with Choudhary et al. [2], Ughade and Mahadkar [3] and Arif et al. [4]

Irrigation intervals did not influence plant stand at 30 DAS and harvest. Dry matter accumulation per plant was significantly influenced by different irrigation intervals. Irrigation at alternate days interval recorded highest dry matter accumulation per plant (10.06, 25.90 and 46.58 g plant^{-1} at 40DAS, 80 DAS and at harvest, respectively). This is in agreement with Akram et al. [5].

Groundnut cultivar HNG-69 recorded highest dry matter accumulation per plant (10.20 g plant^{-1}) as compared to TG-37-A (9.12 g plant^{-1}) but was statistically at par with HNG 123 (10.13 g plant^{-1}) at 40 DAS. This might be due to fast growing and bushy habit of these varieties. Further, the differential behavior among the varieties depends on their genetic makeup and prevailing weather conditions. Kathrivelam and Kalaiselvan [6] and Ramesh et al. [7] at different locations also reported differential growth behaviour of groundnut varieties in terms of plant height, dry matter accumulation, leaf area index and number of branches per plant.

3.2 Yield and Yield Attributes

Irrigation levels of 0.80 PE gave significantly higher pods plant^{-1} and kernels pod^{-1} (44.13 and 2.38 respectively) as compared to 0.60 PE (39.42 and 2.20 respectively). Irrigation at 0.80 PE had recorded higher pod (3117 kg ha^{-1}), haulm and biological yield (7199 kg ha^{-1}) of groundnut as compared to irrigation level 0.60 PE. Optimum moisture conditions coupled with drip fertigation might led to superior yield attributes and maximum economic yield. Harvest index and shelling index were not influenced by applied treatment. Sorensen and Butts [8], Sripunitha et al., [9] and Ughade and Mahadkar [3] also reported similar results.

Irrigation at alternate day interval gave higher pods plant^{-1} and kernels pod^{-1} (43.55 and 2.36 respectively) than that of 3 days interval (40.00 and 2.22 respectively) treatment. Similarly higher pod, haulm and biological yield (2044 3986 and 6980 kg ha^{-1}) was recorded in the same treatment. Harvest index and shelling index have no significant difference with irrigation interval.

Table 1. Effect of irrigation levels and Intervals on plant stand and dry matter accumulation

Treatments	Plant stand (Lakh ha^{-1})		Dry matter accumulation(g plant^{-1})		
	At 30 DAS	At harvest	40 DAS	80 DAS	At harvest
Irrigation levels					
0.60 PE	3.26	2.77	9.66	22.87	43.35
0.80 PE	3.30	2.89	9.98	26.14	47.72
SEm±	0.05	0.04	0.15	0.40	0.47
CD (P=0.05)	NS	NS	NS	1.37	1.63
Irrigation intervals					
Alternate day	3.27	2.86	10.06	25.90	46.58
3 days	3.29	2.81	9.57	23.11	44.49
SEm±	0.08	0.05	0.22	0.59	0.51
CD (P=0.05)	NS	NS	NS	2.04	1.77
Cultivars					
HNG-69	3.17	2.83	10.20	23.58	44.85
HNG-123	3.29	2.81	10.13	25.24	46.08
TG-37-A	3.37	2.87	9.12	24.69	45.67
SEm±	0.07	0.05	0.18	0.49	0.58
CD (P= 0.05)	NS	NS	0.54	NS	NS

Table 2. Effect of irrigation levels and Intervals on yield attributes and yield

Treatments	Pods plant^{-1}	Kernels pod^{-1}	Pod yield (kg ha^{-1})	Kernel yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Biological yield (kg ha^{-1})
Irrigation levels						
0.60 PE	39.42	2.20	2587	1741	3666	6153
0.80 PE	44.13	2.38	3117	2147	4081	7199
SEm±	0.64	0.03	37	23	51	63
CD (P=0.05)	2.22	0.10	127	79	178	217
Irrigation intervals						
Alternate day	43.55	2.36	2993	2044	3986	6980
3 days	40.00	2.22	2711	1843	3661	6372
SEm±	0.67	0.03	53	41	91	75
CD (P=0.05)	2.30	0.11	184	142	315	258
Cultivars						
HNG-69	41.49	2.28	2914	1893	3764	6678
HNG-123	43.45	2.39	2925	2097	3977	6902
TG-37-A	40.39	2.20	2717	1841	3730	6447
SEm±	0.79	0.04	45	28	63	77
CD (P=0.05)	2.36	0.11	134	84	189	231

Table 3. Effect of irrigation levels and Intervals on harvest index (HI), shelling % and test weight of groundnut

Treatments	Harvest index (%)	Shelling (%)	Test weight (g)
Irrigation levels			
0.60 PE	42.07	72.79	428.29
0.80 PE	43.27	71.58	446.58
SEm±	0.46	0.76	3.20
CD (P=0.05)	NS	NS	11.07
Irrigation intervals			
Alternate day	42.87	72.17	443.22
3 days	42.46	72.24	431.65
SEm±	0.88	0.81	3.27
CD (P=0.05)	NS	NS	11.31
Cultivars			
HNG-69	43.58	72.27	467.24
HNG-123	42.24	72.11	470.58
TG-37-A	42.18	72.19	374.09
SEm±	0.57	0.93	3.92
CD (P= 0.05)	NS	NS	11.74

Further irrigation schedules significantly influenced the yield of groundnut. All these parameters increased with decreasing irrigation intervals from 3 days to alternate day. Irrigation at alternate day interval gave highest pods per plant, kernels per pod, pod yield, kernel yield, haulm yield and biological yield. It might be due to adequate availability of water to the crop under hot scorching sun helped the plants to escape from stress and in turn produce more yield attributing characters and yield. Similar kind of results have been reported by Sharma et al., [10], Bagali et. al [11], Zhai et al. [12] and [13].

3.3 Cultivars

Data regarding pods per plant and kernel pod-1(Table 2) showed that highest pods plant-1 and kernel pod-1 were recorded under HNG 123 (43.45 and 2.39), which was at par with HNG 69 (41.49 and 2.28) followed by TG-37-A (40.39 and 2.20 respectively).Groundnut cultivars had significant effect on pod, haulm and biological yield of groundnut. Maximum pod, haulm and biological yield (2097, 3977 and 6902 kg ha-1) were recorded in HNG 123, followed by HNG 69 (1893 3764 and 6678 kg ha-1), respectively. Cultivars have no significant effect on harvest index and shelling percentage. Maximum test weight was recorded under HNG-123 which was statistically at par with HNG-69.

Superior yield attributing characters in variety HNG-123 as compared to other varieties were also recorded in experiments conducted under All India Co-ordinated Research Project on groundnut at ARSS, Hanumangarh, [14]. HNG-123 registered significantly higher pod, haulm and biological yield. The higher yield could be attributed to higher dry matter production and cumulative effect of yield attributes. Similarly, the lowest number of pods, kernels per pod, haulm yield, pod yield, and kernels yield were recorded with the variety TG-37-A. These results are in close conformity with those reported in Co-ordinated advance varietal trials conducted at different locations [14]. Significant and positive correlation existed between yield attributes (pods plant^{-1}, kernels pod^{-1} and seed index) and yield also lend support to these findings. Test weight recorded significantly higher in HNG-123 cultivar which was at par with HNG-69 and lowest in TG-37-A. Results obtained by Thorat et al. [15], Samui et al. [16] and Anonymous [17] also corroborate the findings of present experiment.

4. CONCLUSION

From the above study, it can be concluded that irrigation levels and Intervals had significant effect on growth, yield attributes and yield of groundnut. The application of Irrigation level of 0.80 PE on alternate day irrigation intervals with groundnut cultivars HNG-123 gave higher dry matter accumulation, pods plant^{-1}, kernels pod^{-1}, pod yield, haulm yield, biological yield and test weight.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/67334