Biological Forum – An International Journal **14(1): 829-832(2022)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Effect of Irrigation Levels and Intervals on Yield, Water Use Efficiency and Economics of Groundnut (*Arachis hypogaea* L.) Cultivars under Drip System

Mahendra Kumar Rojh[1], S.R. Bhunia[2], Sundar Anchra[3*], Naresh Kumari[1] and Akshika Bhawariya[1]
[1]Research Scholar, COA, SK Rajasthan Agricultural University, Bikaner, (Rajasthan), India.
[2]Professor and Head, COA, S.K. Rajasthan Agricultural University Bikaner, (Rajasthan), India.
[3]Ph.D. Scholar, Rajasthan College of Agriculture, MPUAT, Udaipur, (Rajasthan), India.

(Corresponding author: Sundar Anchra)*
(Received 02 November 2021, Accepted 05 January, 2022)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: Growing concerns about the environment have made better use of natural resources, less use of chemicals, and more efficient irrigation water use increasingly important goals of sustainable agriculture. As a result, an experiment was conducted during the summer season of 2019 at College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Rajasthan, India. The treatments consist of 2 levels of irrigation *viz.*, 0.60 and 0.80 PE and two interval levels *viz.*, alternate and 3 days in 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. The yield of crop evaluated as pod yield, haulm yield, biological yield and test weight and in terms of water economy water use, water use pattern and water use efficiency. Results revealed that higher pod yield (3117 kg ha^{-1}), kernel yield (2147 kg ha^{-1}), haulm yield (4081 kg ha^{-1}), biological yield (7199 kg ha^{-1}), test weight (446.58 g), water use (806.36 mm), and water use efficiency (3.86 kg ha^{-1}mm^{-1}) with HNG-123 in comparison to other varieties under irrigation level of 0.80 PE and alternate day interval. Therefore, concluded that the HNG-123 with 0.80 PE irrigation level can produce more yield and will be economically effective.

Keywords: haulm yield, kernel yield, biological yield, water use efficiency.

INTRODUCTION

Peanut (*Arachis hypogaea* L.) is an important oilseed and food legume crop of tropical and subtropical areas of the world. Peanut is well known as a dietary component because of its high protein and oil content, among other factors. Its uses in industry have been numerous especially oil extraction. The peanut kernels contain 45–55% oil and 25–34% protein and are the fourth most important source of edible oil and the third most important source of protein in the world. Peanuts contain mostly good fat (unsaturated and free of trans types), which is good for your heart and helps to maintain blood cholesterol levels. Peanut oil is good from both nutritive and culinary point of views as it contains good quantities of monounsaturated fatty acids (MUFA) (oleic acid, 40–50%) and polyunsaturated fatty acids (PUFA) (linoleic acid, 25–35%). With this high oleic/linoleic ratio, peanut oil has a relatively longer shelf-life. The tocopherol (approx. 0.9 mg g^{-1} oils) and antioxidant present in peanut oil prevent the development of rancidity. In India, peanut is one of the important oilseed crops; the total area of groundnut in Rajasthan is 5.90 Lakh ha. and the total production of 14.05 Lakh tons with productivity of 2380 kg ha^{-1} (Anonymous, 2017b), which is quite low as compared to other countries.

Peanut productivity is restricted by a variety of factors, and one of the most critical factors is using water and fertilizer efficiently. It is important to study water management for better results. One of the recent water demand management strategies aimed at controlling water consumption in Indian agriculture is micro irrigation (MI).

This method is mainly based on drip irrigation as opposed to flood irrigation(FMI) micro irrigation utilizes a pipe network, emitters, and nozzles to provide water acertain interval. This reduces conveyance and distribution losses which results in higher water efficiency under drip irrigation. Reduction in water consumption resulting from drip irrigation over surface irrigation varies from 30 to 70 percent for different crops (INCID, 1994; Postal *et al.*, 2001). Based on data

from research stations; micro-irrigation is estimated to increase productivity by 20 to 90 percent for different crops (INCID, 1994, 1998). It also reduces weed problems and soil erosion in addition to increasing crop productivity. In addition to reducing water use, micro-irrigation also reduces the amount of energy needed to lift water from irrigation wells (Narayanamoorthy, 2001).

MATERIALS AND METHODS

This study was conducted during the kharif season of 2019 at Instructional Farm, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner, Rajasthan, India which is located at 28°01'N latitude and 73°22'E longitude at an altitude of 234.70 meters above mean sea level in the arid western hyper arid zone of Rajasthan. According to the average meteorological data of 2019 (June to October), the maximum temperature ranged between 35.0°c and 42.3°c during the crop growing season in the 27th and 25th standard meteorological weeks, respectively. Likewise, the values of minimum temperature *i.e.*, 15.8°c and 20.6°c was recorded in the 44th and 40th standard meteorological weeks, respectively. Crop received 235 mm of rainfall with 13 rainy days in the growing season. Pan evaporation ranged from 6.1 to 12.0 mm day^{-1} during the crop growing period. The average relative humidity during experiment fluctuated in the range of 32.4 to 93.6 per cent.

The soils of experimental unit was poor in organic carbon (0.10%) having available nitrogen of 86.4 kg ha^{-1}, phosphorus of 33 kg ha^{-1}, potassium of 331 kg ha^{-1}. 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 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. The nitrogen and phosphorus were applied through urea and SSP. Nitrogen was applied in two split doses and the full phosphorus dose was applied by drilling at the time of sowing. Afterward, crops were harvested from each net plot area, tagged, and weighed individually. Weight was recorded and expressed in kg ha^{-1}. Total water applied to the field at different PE levels was calculated. The water use efficiency is calculated as the ratio of pod yield to total water used in a treatment. It is expressed in kg ha^{-1} mm^{-1}. Economics was computed using existing prices of inputs and outputs. Benefit: cost ratio was calculated by dividing net returns by cost of cultivation. Data were processed in Microsoft excel 2010 and analyzed by using SPSS 19.0 Version. The least significant difference test was used to compare among different treatments at 5% level of significance ($P< 0.05$).

RESULTS AND DISCUSSION

Results depicted that different irrigation levels along with intervals influenced the yield and water economy of groundnut cultivars. Irrigation at 0.80 PE had recorded higher karnal yield (2147 kg ha^{-1}), haulm yield (4081 kg ha^{-1}) and biological yield (7199 kg ha^{-1}) of groundnut as compared to irrigation level 0.60 PE. The applied treatment had no effect on harvest index or shelling index. During 0.60 PE, water was scarce, which resulted in a very hot summer climate, resulting in poor plant growth. Parallel results found by Yesim *et al.* (2006), Hossain, *et al.* (2015).

Alternate day irrigation interval gave higher karnal yield, haulm and biological yield (2044 3986 and 6980 kg ha^{-1} respectively) of groundnut as compared to 3 days interval. Harvest index or shelling index are not significantly affected by irrigation interval treatment. Additional irrigation schedules significantly affected groundnut yield. All these parameters increased with decreasing irrigation intervals from 3 days to alternate day. During the summer months, there was less water available at three day intervals, resulting in plant mortality and poor growth of plants due to extreme heat, resulting in poor yields. Similar kinds of result have been reported by Khajouei *et al.* (2004); Godara *et al.* (2013); Rao *et al*. (2010)

Table 1: Effect of irrigation levels and Intervals on yield attributes.

Treatments	Kernel yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Biological yield (kg ha^{-1})
Irrigation levels			
0.60 PE	1741	3666	6153
0.80 PE	2147	4081	7199
SEm±	23	51	63
CD (P=0.05)	79	178	217
Irrigation intervals			
Alternate day	2044	3986	6980
3 days	1843	3661	6372
SEm±	41	91	75
CD (P=0.05)	142	315	258
Cultivars			
HNG-69	1893	3764	6678

Maximum pod, haulm and biological yield (2097, 3977 and 6902 kg ha^{-1}) was recorded under HNG 123 groundnut cultivars, followed by was recorded under HNG 69 (1893 3764 and 6678 kg ha^{-1}), respectively. Cultivars have 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, (Anonymous, 2010) (Meena *et al.*, 2014). Higher yields could be attributed to a higher dry matter production and a cumulative effect of yield attributes. They agree closely with the results of the Co-ordinated Advance Varietal trials performed at different locations, where the variety HNG-123 proved superior to other varieties (Anonymous, 2010).

Data (Table 2 and 3) revealed that highest water use (806.36 mm) and WUE (3.90 kg ha^{-1} mm^{-1}) were recorded under at 0.80 PE irrigation levels in groundnut (Zhu *et al.* 2004). And the highest WUE (4.08 kg ha^{-1} mm^{-1}) was recorded with alternate day irrigation intervals compare to irrigation at 3 days interval with cultivar HNG-123 (3.98 kg ha^{-1} mm^{-1}). Himanshu *et al.* (2012); Suresh *et al.* (2013); Sharma *et al.* (2012) were observed same findings.

Data (Table 4) revealed that irrigation at 0.80 PE gave higher net return of ₹ 99,971 ha^{-1} and B:C Ratio of 2.90 over 0.60 PE irrigation level and at alternate day irrigation interval gave higher net return of ₹ 94,821 ha^{-1} and B:C Ratio of 2.83 compare to irrigation at 3 days interval along with HNG 123 (₹ 91,015 ha^{-1}). Tripathy and Bastia (2012); Kamble *et al.* (2018) were observed same finding.

Table 2: Effect of irrigation levels and Intervals on water use and water use efficiency of groundnut.

Treatments	Water use (mm)	WUE(kgha^{-1}mm^{-1})
Irrigation levels		
0.60 PE	661.82	3.90
0.80 PE	806.36	3.86
Irrigation Intervals		
Alternate day	734.09	4.08
3 days	734.09	3.68
Cultivars		
HNG-69	734.09	3.96
HNG-123	734.09	3.98
TG-37-A	734.09	3.71

Table 3: Water use pattern (Growth stage wise).

Treatments	Growth stage (%)				
	Initial stage	Vegetative stage	Reproductive stage	Maturity stage	Total
0.60 PE	16.9	22.0	43.3	17.8	100%
0.80 PE	18.0	19.3	44.5	18.3	100%

Table 4: Effect of irrigation levels and Intervals on economics of groundnut.

Treatments	Net return(₹ha^{-1})	B:C Ratio
Irrigation levels		
0.60 PE	74550	2.42
0.80 PE	99971	2.90
SEm±	1654	0.03
CD (P=0.05)	5723	0.11
Irrigation intervals		
Alternate day	94821	2.83
3 days	79700	2.50
SEm±	2252	0.04
CD (P=0.05)	7794	0.15
Cultivars		
HNG-69	89859	2.71
HNG-123	91015	2.74
TG-37-A	80908	2.54
SEm±	2025	0.04
CD (P= 0.05)	NS	NS

CONCLUSION

HNG-123 produced significantly higher Karnal, haulm and biological yields, and a higher water use efficiency and net return with irrigation at 0.80 PE at alternate day irrigation intervals.

Acknowledgements. The authors are obliged to College of Agriculture, Swami keshwanand Rajasthan Agricultural University, Bikaner Rajasthan for providing necessary facilities and financial for assistance carrying out this study.
Conflict of Interest. None.

REFERENCES

A.O.A.C. (1990). Official methods of analysis, 15th edition. Association of Official Analytical Chemists, Wahington, DC.

Anonymous, (2010). All India Co-ordinated Research Project on groundnut at *ARSS*, Hanumangarh.

Anonymous, (2017b). Vital agricultural Statistics, *Directorate of Agriculture*, Rajasthan.

Godara, S. R., Verma, I. M., Gaur, J. K., Bairwa, Suresh and Yadav, P. K. (2013). Effect of different levels of drip irrigation along with various fertigation levels on growth, yield and water use efficiency in fennel (*Foeniculum vulgare* Mill.). *Asian Journal of Horticulture, 8*(2): 758-762.

Himanshu, S. K., Kumar, S., Kumar, D. and Mokhtar, A. (2012). Effects of Lateral Spacing and Irrigation Scheduling on Drip Irrigated Cabbage *(Brassica Oleracea*) in a Semi-Arid Region of India. *Research Journal of Engineering Sciences, 1*(5): 2278-9472.

Hossain, Md., Belal, Murad ,Khandakar, Faisal, Ibn, Ekram, Sariful, Bin, Rahman, Niaz, Md., Talukder, Farhat, Mahbubur, Rashid, and Ahmed, Mesbauddin (2015) Irrigation Scheduling of Wheat using Pan Evaporation Method International Journal of Innovative Research in Advanced Engineering (IJIRAE). *10*(2).

INCID (1994). Drip Irrigation in India. Indian National Committee on Irrigation and Drainage, New Delhi.

INCID (1998). Drip Irrigation in India. Indian National Committee on Irrigation and Drainage, New Delhi.

Kamble, D. R., Gokhale, D. N., Gadade, D. G. and Jadhav, P. B. (2018). Yield and economics of summer groundnut as influenced by different irrigation level and mulches. *International Journal of Current Microbiology and Applied Sciences*, 6: 135-139

Khajouei-Nejad, G., Kazemi, H., Alyari, H., Javanshir, A. and Arvin, M. J. (2004) Irrigation regimes and plant population density effects on seed yield, protein and oil content of three soybean cultivars. *Turkish Journal of Field Crops*, *9*(2): 62-71.

Meena, M., Yadav, L. R., Yadav, S. S., Sharma, O. P., Choudhary, G. L. and Choudhary P. (2014). Response of fennel (*Foeniculum vulgare*) to irrigation and mulching. *Journal of Spices and Aromatic Crops, 23*(1): 106–109.

Narayanamoorthy, A. (2001) Impact of Drip Irrigation on Sugarcane Cultivation in Maharashtra. Agro-Economic *Research Centre, Gokhale Institute of Politics and Economics*, Pune, June.

Postal, S., Polak, P., Gonzales, F. and Keller, J. (2001) Drip Irrigation for Small Farmers. *A New Initiative to Alleviate Hunger and Poverty, Water International, 26*.

Rao, S.S., Singh, Y.V., Regar, P.L. and Chand, Khem. (2010). Effect of micro-irrigation on productivity and water use of cumin (*Cuminumcyminum*) at varying fertility levels. *Indian journal of Agricultural Sciences, 80*(6): 507-511.

Sharma, S., Halder, A., Patra, S. K. and Ray, R. (2012). Effect of drip irrigation and nitrogen fertigation on water use efficiency (WUE) and cost economics of guava cv. Khaja. *Progressive Horticulture, 44* (1): 136-141.

Suresh, K., Balaguravaiah, D., Ramulu, V. and Rao, S. (2013). Comparative efficiency of sprinkler irrigation over check basin irrigation in groundnut at different irrigation schedules. *International Journal Plant Animal and Environmental. Sciences, 3*(2): 9-13.

Tripathy, S. and Bastia, D.K. (2012). Irrigation and nutrient management for yields augmentation of summer sesame (*Sesamum indicum* L.). *Journal of Crop and Weed*, *8*(2): 53-57.

Yesim, B., Attila, Y., Burçin Gençel, Metin and Semih S. (2006). Optimum lateral spacing for drip-irrigated corn in the Mediterranean Region of Turkey. *Agricultural Water Management*,02/2006.

Zhu, H., Lamb, M. C., Butts, C. L. and Blankenship, P. D. (2004). Improving peanut yield and grade with surface drip irrigation in undulating fields. *Transactions of the ASAE*. *47(*1): 99-106.

How to cite this article: Mahendra Kumar Rojh, S.R. Bhunia, Sundar Anchra, Naresh Kumari and Akshika Bhawariya (2022). Effect of Irrigation Levels and Intervals on Yield, Water Use Efficiency and Economics of Groundnut (*Arachis hypogaea* L.) Cultivars under Drip System. *Biological Forum – An International Journal*, *14*(1): 829-832.