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PB Kotadiya
Department of Agronomy, College of Agriculture, Navsari Agricultural University, Navsari, Gujarat, India

DS Hirpara
Associate Research Scientist, Main dry Farming Research Station, JAU, Targhadia, Rajkot, Gujarat, India

LC Vekariya
Assistant Research Scientist, Department of Soil Science and Agri. Chemistry, Junagadh Agricultural University, Junagadh, Gujarat, India

HN Kanjiya
Department of Agro-Meteoreology, College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat, India

Corresponding Author:
PB Kotadiya
Department of Agronomy, College of Agriculture, Navsari Agricultural University, Navsari, Gujarat, India

Response of summer groundnut (*Arachis hypogaea* L.) to irrigation level and anti-transpirant on quality, soil parameters and economics

PB Kotadiya, DS Hirpara, LC Vekariya and HN Kanjiya

Abstract
The present research work in entitled "Response of summer groundnut (*Arachis hypogaea* L.) to irrigation level and anti-transpirant on quality, soil parameters and economics" was carried out during summer season 2019-20 at Instructional Farm, Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh. The soil of experimental unit was medium black in texture with pH 7.9 and EC 0.33 dS/m. The soil was low in available nitrogen (285 kg/ha), high in available phosphorus (27 kg/ha) and medium in available potash (232 kg/ha). The experiment encompassed of nine combinations, three levels of irrigation schedule and three levels of anti-transpirant embedded in a split plot design with four replications. The details of treatments are as follows, I_1AT_1 [0.6 IW/CPE + Control (water spray)], I_1AT_2 (0.6 IW/CPE + Kaolin 6% spray at 45 and 75 DAS), I_1AT_3 (0.6 IW/CPE + PMA 0.032% spray at 45 and 75 DAS), I_2AT_1 [0.8 IW/CPE + Control (water spray)], I_2AT_2 (0.8 IW/CPE + Kaolin 6% spray at 45 and 75 DAS), I_2AT_3 (0.8 IW/CPE + PMA 0.032% spray at 45 and 75 DAS), I_3AT_1 [1.0 IW/CPE + Control (water spray)], I_3AT_2 (1.0 IW/CPE + Kaolin 6% spray at 45 and 75 DAS) and I_3AT_3 (1.0 IW/CPE + PMA 0.032% spray at 45 and 75 DAS). The quality, soil parameter and economics were significantly affected by different irrigation scheduling and anti-transpirant treatments and recorded significantly higher with 1.0 IW/CPE irrigation scheduling and kaolin anti-transpirant treatments.

Keywords: anti-transpirant, groundnut, irrigation schedule, IW/CPE, kaolin, phenyl mercuric acid and water use efficiency

Introduction
Groundnut is also known as peanut (*Arachis hypogaea* L.) belongs to family of fabaceae, it is considered as one of the most popular and universal crops cultivated in more than 120 countries. It is an annual legume which is also known as an earthnut, money-nut and goobers. It is the 13th most important food crop and 4th most important oilseed crop of the world. Groundnut seed contains about 50% edible oil. Groundnut is the "King of Oilseeds". Groundnut is commonly cultivated as a food and feed crop that provides pods for human and haulms for livestock feeding. In India, groundnut is known as poor man's almond. Groundnut kernels are an excellent source of plant protein content 27 to 33% and 45 to 50% oil content as well as essential minerals, carbohydrates and vitamins. Groundnut oil is composed of mixed glycerides and contains a high proportion of unsaturated fatty acids viz., oleic (50 to 65%) and linoleic (18 to 30%). The by-products of this crop like haulm and cake have good nutritive value. The groundnut cake obtained after groundnut extraction is rich in protein and considered as valuable organic manure and animal feed, which contains 7 to 8% N, 1.5% P_2O_5 and 1% K_2O. Some industrial products like paints, varnishes, soap and lubricating oils are also manufactured from groundnut. The most important groundnut growing countries in the world are India, China, Nigeria, Senegal, Sudan, Burma and USA. India ranks first in acreage and with an output of about 85 lakh MT of in shell groundnuts, second in production. India also happens to be one of the largest exporters in the world and competes closely with Argentina, USA and China by commanding a share of 20-25% in global markets. For advance estimating in Gujarat production from 2018-19 groundnut crop is 2.695 MT in 1.468 Mha and summer groundnut production 93000 tons in 52000 ha in 2017-18. In India, Gujarat, Tamil Nadu, Andhra Pradesh, Karnataka and Maharashtra are the major groundnut producing states. Gujarat is the leading producer contributing 29.63% of the total production followed by Tamil Nadu (20.78%), Andhra Pradesh (15.23%), Rajasthan (8.23%), Maharashtra (8.23%) and Karnataka (7.82%). Gujarat, Andhra Pradesh, Tamil Nadu and Karnataka together account for

77% of the area and almost 75% of the production of groundnut in India. In Gujarat, groundnut is premier oilseed crop with an area of 1.76 million ha and a production of 3.16 million tons with productivity of 1795 kg/ha (Anon. 2018).

Irrigation scheduling is one of the important managerial activities and affects the effective an efficient utilization of water by crops. It determines the process to decide when to irrigate the crops and how much water to apply. It optimizes agricultural production with minimizing yield loss due to water shortage and improving performance and sustainability of any irrigation system through conserving water. Scheduling irrigation on the basis of evaporative demand results not only in efficient utilization of water but also in considerable saving of water. Anti-transpirant is any chemical material applied to transpiring plant surfaces for reducing water loss through transpiration and mitigate plant water stress by increasing the leaf resistance to the diffusion of water vapor. The use of anti-transpirant reduces excessive transpiration in plants and makes it possible to manipulate plant water status artificially. Among them the use of metabolic inhibitors such as Phenyl Mercuric Acetate (PMA) and light reflecting materials such as Kaolin.

Materials and Method

In order to achieve the pre-set objectives of the present exploration, a field experiment was conducted during the summer season of the year 2019-20 on C-7 plot of Instructional Farm, Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh (Gujarat). The experimental site had an even topography with moderate slope and medium calcareous soil. Data on initial soil analysis indicated that the experimental site was was medium black texture and slightly alkaline in reaction with pH 7.9 and EC 0.33 dS/m. The soil was low in available nitrogen (285 kg/ha), high in available phosphorus (27 kg/ha) and medium in available potash (232 kg/ha). The present experiment was laid out in split plot design with nine treatments combinations of irrigation schedule and anti-transpirant with four replications. The collected data for various parameters were statistically analyzed using Fishers analysis of variance (ANOVA) technique and the treatments were compared at 5% levels of significance. All the observation, growth and yield parameter was taken as per standard method.

Results and Discussion

Effect of irrigation scheduling

Quality parameter *viz*., shelling percentage, oil content, oil yield (kg/ha), protein content and protein yield (kg/ha) significantly higher when groundnut was irrigated under IW/CPE ratio of 1.0 (I_3) which remained at par with I_2 (0.8 IW/CPE ratio), while shorter quality parameters was noted when crop was irrigated at an IW/CPE ratio of 0.6 (I_1). These results are in conformity with the findings of those reported by Krishna and Ramannjaneyulu (2012) [3].

Soil moisture parameters *viz*., consumptive use of water and water use efficiency revealed that consumptive use of water increased with increase in number of irrigations from I_1 (0.6 IW/CPE ratio) to I_3 (1.0 IW/CPE ratio). Treatments I_1, I_2 and I_3 which received 13, 17 and 20 irrigations with 650, 850 and 1000 mm of irrigation water recorded 563.27, 689.43 and 844.15 mm of CUW, respectively. Of these I_3 (1.0 IW/CPE ratio) recorded the highest CUW followed by I_2 (0.8 IW/CPE ratio). Increase in CUW with more number of irrigations was due to more availability of water for evapotranspiration and further water loss through evapotranspiration would be more from well-watered plants having higher leaf water potential than those having lower water potential under similar atmospheric evaporative conditions. water use efficiency increased with decreases number of irrigations from I_3 to I_1. WUE decreased with increasing number of irrigations and recorded lower WUE under treatment I_3 (1.0 IW/CPE ratio). Higher water use efficiency under I_1 (0.6 IW/CPE ratio) might be due to less quantity of irrigation water application and low yield. Similar effect of irrigation on consumptive use of water and water use efficiency were observed by Raskar and Bhoi (2003) and Patel *et al*. (2008) [5, 4]. Among the different irrigation schedules, irrigating the groundnut crop at an IW/CPE ratio of 1.0 registered maximum gross and net realization as well as B: C ratio respectively followed by 0.8 IW/CPE ratio with giving gross and net realization as well as B: C ratio. Groundnut irrigated at 0.6 IW/CPE ratio recorded minimum gross and net realization and B: C ratio.

Effect of anti-transpirant

Quality parameter *viz*., shelling percentage, oil content, oil yield (kg/ha), protein content and protein yield (kg/ha) significantly higher when groundnut was treatment AT_2 (application of Kaolin 6% spray at 45 and 75 DAS) registered significantly higher quality parameters, which was statistically at par with treatment AT_3 (application of PMA 0.032% spray at 45 and 75 DAS). However, the treatment AT_1 (application of water spray at 45 and 75 DAS) recorded significantly the lowest quality parameter. The results confirm the findings Chitodkar *et al*. (2005) [2].

Higher WUE of was noticed when groundnut crop was applied with Kaolin 6% spray at 45 and 75 DAS (AT_2). Lower WUE recorded under application of water at 45 and 75 DAS.

The consumptive use of water was influenced due to the treatment of anti-transpirant. The consumptive use of water was significantly lower in the treatment of Kaolin 6% spray at 45 and 75 DAS and followed by treatment of PMA 0.032% spray at 45 and 75 DAS. while the consumptive use of water was significantly higher in the water spray. Among the different anti-transpirant that application of Kaolin 6% spray at 45 and 75 DAS (AT_2) gave maximum gross and net realization as well as B: C ratio. Groundnut on application of phenyl mercuric acetate @ 0.032% at 45 and 75 DAS (AT_3) gave minimum net realization as well as B: C ratio.

Table 1: Effect of irrigation scheduling and anti-transpirant on quality parameter

Treatment	Shelling percentage	Oil content (%)	Oil yield (kg/ha)	Protein content (%)	Protein yield (kg/ha)
(A) Main plot treatment : Irrigation scheduling (I)					
I_1 : 0.6 IW : CPE	63.90	44.51	433.67	19.09	187.94
I_2 : 0.8 IW : CPE	66.37	45.41	537.96	21.82	242.29
I_3 : 1.0 IW : CPE	67.80	47.51	595.85	22.44	300.88
SE.M ±	0.82	0.66	17.34	0.55	21.10
C.D. at 5%	2.84	2.27	60.0	1.92	73.03
C.V %	4.31	4.95	11.50	9.08	10.00
(B) Sub plot treatment : Anti-transpirant (AT)					
AT_1 : Control (Water spray at 45 and 75 DAS.)	63.97	44.69	450.56	19.95	207.06
AT_2 : Kaolin 6% spray at 45 and 75 DAS.	67.40	46.97	570.75	21.72	281.00
AT_3 : PMA 0.032% spray at 45 and 75 DAS.	66.71	45.78	545.98	21.68	243.05
SE.M ±	0.64	0.60	14.45	0.49	19.45
C.D. at 5%	1.91	1.79	42.8	1.45	57.80
C.V %	3.37	4.55	9.55	8.01	9.22
(C) Interaction effect (I X AT)					
SE.M ±	4.58	4.58	4.58	4.58	4.58
C.D. at 5%	NS	NS	NS	NS	NS

Table 2: Effect of irrigation scheduling and anti-transpirant on soil parameters and economics

Treatment	Water use efficiency (kg/ha-mm)	Consumptive use of water (mm)	Gross return (₹/ha)	Total cost (₹/ha)	Net return (₹/ha)	B: C ratio
(A) Main plot treatment : Irrigation scheduling (I)						
I_1 : 0.6 IW : CPE	2.27	563.27	57706	30658.69	27047.31	1.88
I_2 : 0.8 IW : CPE	1.94	689.43	63486	32805.36	30680.64	1.93
I_3 : 1.0 IW : CPE	1.80	844.15	68581	34415.36	34426.64	2.00
(B) Sub plot treatment: Anti-transpirant (AT)						
AT_1: Control (water spray at 45 and 75 DAS)	1.87	545.64	59743	23682.02	36060.95	2.52
AT_2: Kaolin 6% spray at 45 and 75 DAS.	2.20	529.11	67610	26290.22	41319.78	2.57
AT_3: PMA 0.032% spray at 45 and 75 DAS.	1.94	532.57	62373	40375.4	21997.6	1.54

Conclusion

On the basis of one-year field experimentation in summer season, it seems quite logical to conclude that under medium black calcareous soil of South Saurashtra Agro-climatic Zone for getting quality parameter and economics of groundnut (Cv. TG-37-A) crop should be provided as surface irrigation each of 50 mm depth to be scheduled at 1.0 IW/CPE ratio along with the application of Kaolin 6% spray at 45 and 75 DAS (AT_2).

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