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Studies on irrigation regimes, mulches and antitranspirant on yield and water requirement of *summer* groundnut (*Arachis hypogaea* L.)

Sanjay S. Chitodkar, Pramod M. Chaudhari*, Harshal E. Patil[1] and Pankaj U. Raundal
Department of Agronomy, Mahatma Phule Krishi Vidyapeeth, College of Agriculture, DHULE (M.S.) INDIA

ABSTRACT
A field experiment on response of summer groundnut to irrigation regimes, mulches and antitranspirant was conducted on summer groundnut variety JL-220 (Vyas) at water management project, MPKV, Rahuri. It was observed that, the dry pod yield, haulm yield and kernel yield of groundnut were significantly maximum due to irrigation scheduled at 75 mm CPE than at 100, 125 and 150 mm CPE. Total consumptive use of water was higher with minimum WUE (4.66 Kg/ha/mm) when the irrigation scheduled at 75 mm CPE (736 mm). The water use efficiency was maximum when irrigation scheduled at 100 mm CPE (5.27 kg/ha/mm). On an average evapotranspiration losses reduced to the extent of 25.68,13.99 and 3.94 per cent due to the use of plastic film, Sugarcane trash @ 5 tonnes/ha and kaoline 8 per cent spray, respectively. The water use efficiency (6.95 kg/ha/mm) was maximum with the use of plastic film + kaoline 8 percent spray and was minimum with control treatment (3.58 kg/ha/mm). The growing of summer groundnut on BBF with irrigation scheduled at 75 mm CPE, using plastic film + kaoline 8 per cent spray was beneficial for achieving higher productivity and reducing evapotranspiration losses in summer groundnut. The use of sugarcane trash mulch @ 5 tonnes /ha was also equally beneficial.

Key words : Irrigation regimes, Mulches, Antitranspirant, Water requirement, Water use efficiency, Consumptive use and Broad bed furrow.

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is one of the most important oilseed crop of Maharahstra state and predominantly grown in an area of about 1.25 lack hectare with annual production of 1.45 lack metric tonneses and average productivity of 12.60 q/ha Borole (1986) found that irrigation scheduling at 75 mm CPE gave significantly maximum yield of summer groundnut when compared with 100 mm and 125 mm CPE. In recent years, some useful techniques have been evolved to minimize water losses through transpiration and evapotranspiration, such as use of straw mulch, plastic film mulch and antitranspirant. If both of them are used simultaneously, there is possibility of cumulative effect on reducing evapotranspiration losses. Use of straw mulch at 5 tonnes /ha alone with spraying of 8 per cent kaoline from the stage of flowering onwards has proved to produced higher yield in summer groundnut (Anonymous, 1978). Use of plastic film mulch has an important role in increasing the yield and checking weed population. With this background field experiment on response of summer groundnut to irrigation regimes, mulches and antitranspirant was conducted.

MATERIALS AND METHODS

Studies on response of summer groundnut to irrigation regimes, mulches and antitranspirant was carried out during summer season 1999-2000 at water management project, MPKV, Rahuri in a spilt plot design with four replications, comprising 24 treatment combinations of irrigation regimes placed on cumulative pan evapotranspiration i.e. 75,100,125 and 150 mm CPE and 6 sub plot treatments of mulches and antitranspirant viz. sugarcane trash @ 5tonnes/ha, plastic film mulch, kaoline 8 per cent spray, sugarcane trash @ 5tonnes/ha + kaoline 8 per cent spray, plastic film mulch+ kaoline 8 per cent spray and control. The soil of the experimental field was clay in texture, low in available nitrogen (211.70 kg/ha) and phosphorus (8.53 kg/ha), high in available potassium (414.40 kg/ha) and was alkaline in reaction with 44.06 per cent moisture content at 1/3 bar (FC) and 25.45 per cent moisture at 15 bar (PWP). The bulk density of 0-30 cm soil depth was 1.29 g/cm^3. The summer groundnut variety JL-220 (Vyas) was dibbled at the spacing of 30 X 6.67 cm on 26.02.1999. The gross and net plot size was 5.00 x 3.60m and 4.00 X 2.70 m respectively. The broad bed furrow was prepared with of 60 cm at the top and 90cm width at the bottom. Four beds in each plot were accomoded and two rows on each bed were sown by dibbling. For 75 mm CPE total 12 irrigation, 100 mm CPE total 10 irrigations, 125 mm CPE total 8 irrigations and for 150 mm CPE total 7 irrigations were given, including pre sowing irrigation, first and second common irrigations.

RESULTS AND DISCUSSION

Effect of irrigation regimes:

The application of irrigation at 75 mm CPE produced significantly higher dry pod yield 34.29 q/ha than rest of irrigation treatments. Further, dry pod yield significantly decreased with increasing levels of CPE. Irrigation at 100, 125 and 150 mm CPE produced 32.96, 30.09 and 27.92 q/ha dry pod yield respectively (Table-1).

The favourable soil moisture condition created in the rhizospher of summer groundnut at higher irrigation regimes of 75 mm CPE reflected in increasing vegetative growth in form of morphological characters and finally the total biomass production and dry pod yield. The lowest dry pod yield 27.92 q/ha was found with irrigation given at 150 mm CPE and was improved by 7.21, 15.29 and 18.58 per cent with the application of irrigation at 125,100 and 75 mm CPE respectively. Similar trend was observed in respect of haulm yield and kernel yield. It was also noticed that moisture stress conditions prevailed due to higher CPE values, which adversely affect the production of summer groundnut. Similar increasing in productivity of groundnut was reported by Sabale (1980), Borole(1986), Bachchhav (1990) and Dhamane (1991).

Effect of mulches and antitranspirant

The dry pod yield was maximum to the extent of 35.58 q/ha with the application of plastic film + kaoline 8 per cent spray and was significantly higher than the rest of the treatments. However, this treatment was on par with treatment of plastic film mulch alone. Similarly, sugarcane trash + kaoline 8per cent spray was on par with the treatment of sugarcane trash mulch along. Minimum dry pod yield was recorded in the treatment of control (26.33q/ha) followed by kaoline 8per cent spray alone (27.21q/ha).

The application of plastic film +kaoline 8 per cent spray, plastic film mulch alone, sugarcane trash + kaoline 8 percent spray and sugarcane trash mulch alone increased dry pod yield by 26.00, 23.41, 19.68,16.67 per cent, respectively, over the treatment of control. This indicates that groundnut crop responded well to application of mulches and antitranspirant. It appeared that various mulches i.e. plastic film and sugarcane trash mulch might have enhanced microbial activities due to favourable soil temperature and

[1] Anand Agrl. University, Anand (Gujrat) India
***Author for correspondence**

Table 1: Mean dry pod yield, haulm yield, kernel yield (q/ha) and harvest index as influenced by different treatments

Treatments	Dry pod yield (q/ha)	Haulm yield (q/ha)	Kernel yield (q/ha)	Harvest index (%)
Irrigation regimes				
75 mm CPE	34.29	69.04	23.50	33.06
100 mm CPE	32.96	66.08	22.29	33.15
125 mm CPE	30.09	62.21	20.08	32.51
150 mm CPE	27.92	58.52	18.35	32.52
S.E.±	0.23	0.84	0.10	0.40
CD at 5 %	0.80	2.92	0.34	-
Mulches and Antitranspirant				
Sugarcane trash @ 5t/ha	31.60	63.29	21.19	33.66
Plastic film mulch	34.38	65.76	23.19	34.32
Kaoline (8%) spray	27.21	62.13	18.22	30.47
Sugarcane trash @ 5t/ha + kaoline (8%) spray	32.78	64.27	22.06	33.73
Plastic film + kaoline (8%) spray	35.58	66.98	24.07	34.62
Control	26.33	61.32	17.60	30.05
S.E.±	0.43	1.01	0.31	0.53
CD at 5 %	1.22	2.88	0.90	1.51
Interactions effects				
'F' test	N.S.	N.S	N.S	N.S

N.S. = Not significant Sig. = significant

soil moisture conditions in the rhizosphere of groundnut resulting in quick release of nutrients and their uptake, which ultimately increased the pod yield of groundnut. The treatments of mulching resulted in moderating the soil temperature during summer season in groundnut, and which increased dry pod yields. Similar results were obtained in respect of haulm and kernel yield. These finding are in conformity with those reported by Joshi et al. (1987), Tayel et al. (1993) and Shyam Sundar(1999).

Irrigation studies

Effect of irrigation regimes

The profile water development was increased with decreased levels of CPE. The net quantity of irrigation water was applied in treatment 75mm CPE to 150 mm CPE varied considerably due to different irrigation regimes scheduled as per different CPE values. Average depth of water applied in different irrigation regimes was 66.9, 68.9, 70.2 and 74.3 mm for treatments of 75, 100,125 and 150 mm CPE, respectively (Table -2).

The consumptive use of water increased with the increased levels of irrigations. The mean maximum consumptive use of water 736 mm when irrigation were scheduled at 75 mm CPE. This was followed by 100 mm (626mm) 125 mm (580mm) and 150 mm (547mm) CPE treatments. The per day consumptive use of water in various irrigation treatment followed similar trend as that of total consumptive use of water.

The consumptive use of water at 75 mm CPE was higher than the rest of the irrigation levels indicating that wet regimes with frequent irrigation provided wet surface for long period resulting in grater loss of soil moisture due to evapotranspiration. Frequent irrigated crops produced profuse vegetative growth causing more evapotranspiration losses and were required higher consumptive use of water. The WUE was maximum in case of 100mm CPE treatment (5.27kg/ha/mm) followed by 125 mm CPE (5.18kg/ha/mm) irrigation treatments. Minimum WUE was observed with the highest levels of irrigation 75 mm CPE. The results confirm finding of Joshi *et al*. (1987) and Patel *et al*. (1988).

Effect of mulches and antitranspirant

The mean depletion of soil moisture was less in the treatment of plastic film + kaoline 8 per cent spray (451.5mm). However, the profile water depletion was higher under the treatment of plastic film mulch alone (486.5) mm, sugarcane trash + kaoline 8 per cent spray (537.5mm), sugarcane trash mulch alone (572.5mm), kaoline 8 per cent spray alone (646.5mm) and control treatment (675.5mm). On an average total irrigation water applied was 643.5mm. The seasonal water required remain constant being 704mm in the mulching and antitranspirant treatments.

The total CUW was significantly lower in the treatment of plastic film + kaoline 8 per cent spray (512mm) as compared to the rest of the treatments. This was followed by application of plastic film mulch alone (547mm), sugarcane trash + kaoline 8 per cent spray (598mm), sugarcane trash mulch alone (633mm) and kaoline 8per cent spray alone (707mm). The mean total CUW was maximum in the treatment of control (736mm). Similar trend was noticed in respect of mean daily consumptive use of water during the crop growth period.

The mean total CUW was found to be minimum due to application of plastic film +kaoline 8 per cent spray. This might be due to reduced evapotranspiration loss from the soil surface and transpiration losses from plant canopy.

The WUE was maximum due to the application of plastic film + kaoline 8 per cent spray (6.95kg/ha/mm) as compared to the rest of the treatments. Which ranged from 3.84 to 6.28 kg/ha/mm. Minimum WUE was recorded in the treatment of control (3.58kg/ha/mm). Similar finding were reported by Borole(1986), Bachchhav (1990) and Dhamne(1991).

The irrigation scheduled at 75mm CPE found to be beneficial in increasing pod yield of summer groundnut with use of plastic film + kaoline 8 per cent spray give significantly higher yield than rest of the mulch treatments. The use of sugarcane trash mulch @ 5tonnes/ ha was also equally beneficially in increasing the yield of summer groundnut. Interaction effect between factors under studies was found to be non-significant.

Table 2 : Profile water depleted, irrigation water applied, effective rainfall, total consumptive use, consumptive use per day, seasonal water requirement and water use efficiency(WUE) as influenced by different treatments

Treatment	Profile water depleted (mm)	Irrigation water applied (mm)	Effective rainfall (mm)	Total consumptive use (mm)	Consumptive use per day (mm)	Seasonal water requirement (mm)	Water use efficiency Kg/ha/mm
Irrigation regimes							
75 mm CPE	699	803(66.9)	37	736	5.93	840	4.66
100 mm CPE	553	689(68.9)	73	626	5.05	762	5.27
125 mm CPE	515	562(70.2)	65	580	4.68	627	5.18
150 mm CPE	480	520(74.3)	67	547	4.41	587	5.10
Mulches and							
Antitranspirant							
Sugarcane trash @ 5t/ha	572.5	-	60.5	633	5.10	-	4.99
Plastic film mulch	486.5	-	60.5	547	4.41	-	6.28
Kaoline (8%) spray	646.5	-	60.5	707	5.70	-	3.84
Sugarcane trash @ 5t/ha	537.5	-	60.5	598	4.82	-	5.48
+ kaoline (8%) spray							
Plastic film + kaoline (8%) spray	451.5	-	60.5	512	4.13	-	6.95
Control	675.5	-	60.5	736	5.93	-	3.58
General mean	561.7	643.5	60.5	622	5.02	704	5.03

1. Duration of the crop was 124 days
2. Figures in parenthesis indicate the average depth of water applied.

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