Madras Agric. J., 82(5): 341-344 May, 1995
https://doi.org/10.29321/MAJ.10.A01201

IMPACT OF IRRIGATION MANAGEMENT PRACTICES AND SOIL AMENDMENTS IN GROUNDNUT

ARUNA RAJAGOPAL, N.ASOKARAJA and G.VELU
Water Technology Centre,
Tamil Nadu Agricultural University, Coimbatore 641 003

ABSTRACT

Field experiments conducted at the Agricultural college and Research Institute Farm, Tamil Nadu Agricultural University, Coimbatore during monsoon 1990 and summer 1991 to study the irrigation management practices on groundnut with special reference to irrigation field layouts and soil amendments revealed that irrigating groundnut at 0.75 IW/CPE ratio with ridges and furrows and coir waste at 15 $t.ha^{-1}$ resulted higher productivity, net return and benefit: cost ratio under adequate water supply. Under water scarcity conditions irrigation even at 0.5 and o.6 IW/CPE ratio with flat ridges and furrows with 10-15 $t.ha^{-1}$ of coir waste recorded higher water use efficiency without appreciable reduction in groundnut pod yield.

KEY WORDS : Irrigation, Layouts, Amendments.

Groundnut is the most important oil seed crop in India. It is grown in 7.22 m.ha with a production of 5.42 m tonnes. In Tamil Nadu, the area under groundnut is 1.08 m.ha with total production of 1.25 m.tonnes. Eventhough India ranks first in area, its productivity is low compared to other groundnut growing countries. Irrigation is the most important constraint input for greater productivity. Scheduling irrigation based on climatological approach (IW/CPE ratio) is the versatile method in predicting the water requirement and for enhancing the water use efficiency of a crop. Thanzuala (1988) have indicated that irrigating groundnut at 0.75 IW/CPE ratio was found to be optimum and achieved higher water use efficiency in groundnut. Water use by the crop can be minimised by adoption of appropriate irrigation layout. Rasve *et al.* (1993) found that groundnut grown in ridges and furrows gave higher yield than flat bed. Application of amendments not only improve the soil physical properties but also enhance the nutrient availability to crops. Application of farm yard manure at 12.5 $t.ha^{-1}$ (Mohamed Ali *et al.*, 1974) gave significantly higher yields as compared to control. Coir waste is an excellent organic material for improving, soil physical and chemical properties. Coir waste application reduced the *in situ* bulk density of soil from 1.72 to 1.42 g. cc^{-1} (Ramaswami and Sree Ramulu, 1983), increase the infiltration rate and hydraulic conductivity of soil (Mayalagu *et al.*, 1983), increase the build up of total N in soil (Ramaswami and Kothandaraman, 1985), increase the soil moisture content (Subramanian, 1980) and enhance groundnut pod yield at 20 $t.ha^{-1}$ (CPRWM, 1980). Limited works have been carried out in groundnut with irrigation layout and influence of soil amendments. Keeping these aspects in view, the present study was undertaken to evaluate the irrigation field layout and soil amendments for conserving water use by groundnut and increase the groundnut yields.

MATERIALS AND METHODS

Field experiments were conducted at the Agricultural College and Research Institute Farm, Coimbatore during monsoon, 1990 and summer, 1991 in groundnut variety Co.2. The soils of experimental fields (F.No.68 and 71) were sandy loam, with low in available N (264.2 and 378.5 kg ha^{-1}), medium in available P (18.6 and 23.2 kg ha^{-1}) and high in available K (364.3 and 281.5 kg ha^{-1}). The pH of the soils were 8.4 and 8.2 with 0.32 and 0.31 per cent organic carbon content respectively. The field capacity was 19.2 and 19.4 per cent respectively. Experiments were conducted in split plot design with levels of irrigation and field layouts in main plot and soil amendments in sub-plot replicating the treatments thrice. Two irrigation levels 0.5 (I_1) and 0.75 (I_2) IW/CPE ratio (second crop) and three field layouts viz., basin system (L_1), ridges and furrows (L_2) and flat ridges and furrows (L_3) were allotted to main plot. In subplot coir waste incorporation at 10 $t.ha^{-1}$ (A_1), 15 $t.ha^{-1}$ (A_2) and FYM incorporation at 12.5 $t.ha^{-1}$ (A_3) were allotted. All the other cultural practices to groundnut were commonly followed as per

Table 1. Growth, yield attributes and yield of groundnut (Co.2) and water use efficiency as influenced by treatments in monsoon, 1990

Treatments	Plant height at harvest (cm)	Leaf area index at 90 DAS	Dry matter production at harvest kg ha^{-1}	No. of matured pods plant^{-1}	Hundred pod weight (g)	Pod yield kg ha^{-1}	Total water used (mm)*	Water use efficiency kg ha mm^{-1}*
I_1 - Irrigation 0.50 IW/CPE	27.1	1.96	2900	15.5	74.9	1790	376	4.76
I_2 - Irrigation 0.75 IW/CPE	29.3	2.24	3246	18.3	82.1	1888	502	3.26
Cd (P=0.05)	0.19	0.002	49.3	0.25	1.26	21	-	-
L_1 - Basin System	26.3	1.90	2901	16.0	73.2	1758	458	3.84
L_2 - Ridges and furrows	29.9	2.30	3223	17.9	84.0	1926	420	4.59
L_3 - Flat ridges and furrows	28.5	2.10	3095	16.9	78.3	1836	401	4.58
Cd (P=0.05)	0.23	0.003	60.4	0.30	2.60	25	-	-
A_1 - Coir waste 10 t ha^{-1}	28.1	2.09	3135	16.9	78.3	1836	426	4.31
A_2 - Coir waste 15 t ha^{-1}	29.8	2.44	3499	18.0	81.2	1984	426	4.66
A_3 - Farm yard manure 12.5 t ha^{-1}	26.7	1.77	2585	15.9	76.0	1698	426	3.99
CD (P=0.05)	1.14	0.090	127.8	0.81	0.84	52	-	-

* Data not analysed statistically; DAS - Days after sowing.

recommendation. Growth characters in groundnut viz., plant height, leaf area index, dry matter production and yield characters like number of pods/plant, hundred pod weight and groundnut pod yields were recorded. Water use efficiency was also computed for various treatments.

RESULTS AND DISCUSSION

The data of the two experiments monsoon, 1990 and summer, 1991 are separately presented in Tables 1 and 2 for the corresponding seasons since the irrigation levels varied in these two seasons.

Growth characters

Irrigation at 0.75 IW/CPE ratio (I_2) registered higher plant height significantly in both the seasons (Tables 1, 2). The ridges and furrows (L_2) was found to be superior in recording higher plant height in groundnut and application of coir waste at 15 t.ha^{-1} (A_2) had resulted increased plant height markedly in both the seasons. Also these treatments recorded higher leaf area index (LAI) at 90 DAS in both seasons as compared to rest of the treatments. Similar trend of results could be seen with regard to dry matter production in groundnut at harvest stage. Increase in growth attributes of groundnut due to irrigation of 0.75 IW/CPE ratio, ridges and furrows and coir waste incorporation at 15 t.ha^{-1} was reported by various researchers (Durai, 1982 Rasve *et al.*, 1983).

Yield attributes and yield

With references yield attributes, number of matured pods per plant and hundred pod weight were significantly higher with irrigation at 0.75 IW/CPE. Positive correlation between number of matured pods and number of irrigations was obtained by Madhu Sudhana Rao *et al* (1988). Number of matured pods and hundred pod weight were significantly higher under ridges and furrows compared to other layouts. These yields attributes were also favourably influenced by coir waste incorporation at 15 t.ha^{-1} (A_2)as compared to 10 t.ha^{-1} and farm yard manure 12.5 t.ha^{-1}. This was possible due to increased growth attributes viz., higher plant height, more number of compound leaves, increased LAI and DMP. Similar results were reported by Durai (1982).

Pod yield

In both the seasons the pod yield of groundnut (Co.2) was significantly higher with irrigation at 0.75 IW/CPE ratio through ridges and furrow system. Higher pod yield was registered due to incorporation of coir waste at 15 t.ha^{-1}. The yield increase under ridges and furrows might be due to

Table 2. Growth, yield attributes and yield of groundnut (Co.2) and water use efficiency as influenced by treatments in Summer 1991

Treatments	Plant height at harvest (cm)	Leaf area index at 90 DAS	Dry matter production at harvest kg ha^{-1}	No. of matured pods plant^{-1}	Hundred pod weight (g)	Pod yield kg ha^{-1}	Total water used (mm)*	Water use efficiency kg ha mm^{-1}*
I_1 - Irrigation 0.50 IW/CPE	35.5	2.20	4410	20.4	79.0	2693	433	6.21
I_2 - Irrigation 0.75 IW/CPE	39.6	2.57	4765	22.9	86.1	2951	514	5.75
Cd (P=0.05)	0.18	0.004	5	0.14	0.70	105	-	-
L_1 - Basin System	35.5	2.30	4266	20.9	77.2	2666	507	5.25
L_2 - Ridges and furrows	39.8	2.46	4888	22.7	88.0	2985	467	6.39
L_3 - Flat ridges and furrows	37.5	2.40	4610	21.3	82.5	2815	449	6.26
Cd (P=0.05)	0.22	0.005	6	0.18	1.50	129	-	-
A_1 - Coir waste 10 t ha^{-1}	37.3	2.40	4724	21.8	82.5	2819	426	6.63
A_2 - Coir waste 15 t ha^{-1}	40.4	2.49	5103	22.9	85.2	2982	426	7.01
A_3 - Farm yard manure 12.5 t ha^{-1}	35.0	2.29	3936	20.2	80.0	2665	426	6.27
CD (P=0.05)	1.01	0.008	194	0.83	0.84	120	-	-

DAS - Days after sowing.

favourable and optium availability of soil moisture with uniform flow of water, lesser weed competition because of lesser wetted periphery and enhanced yield attributes. These resultes were in conformity with findings reported by Rasve *et al.* (1983). Higher yields under coir waste incorporation at 15 t.ha^{-1} (A_2) might be attributed to more moisture retention capacity, improved soil physical conditions such as hydraulic conductivity and bulk density (data not reported here) resulted in loose and friable soil condition conducive for better pod formation.

Water use by groundnut

The water use efficiency was higher in summer, 1991 as compared to monsoon, 1990. In monsoon, 1990 the total water used under 0.75 IW/CPE was 502 mm which required 12 irrigations at 7-8 days intervals as compared to 0.50 IW/CPE wherein the total water use 376 mm in 7 irrigations at 12 days interval. The water use efficiency was 4.76 kg.ha mm^{-1} and 3.76 kg.ha mm^{-1} in 0.50 and 0.75 IW/CPE ratio respectively.

In summer 1991 total water consumption in groundnut under 0.75 IW/CPE was 514 mm in 11 irrigation at 7-8 days interval. This was reduced to 433 mm with 9 irrigations at 9-10 days under 0.60 IW/CPE. The water use efficiency was 6.21 and 5.75 kg.ha mm^{-1} under 0.60 and 0.75 IW/CPE ratio respectively. Higher water use efficiency with lower regimes might be due to lesser quantity of water used.

Ridges and furrows followed by flat ridges and furrows were effective in reducing the total water consumption besides higher water use efficiency as compared to basin system in both seasons. Coir waste incorporation 15 t.ha^{-1} recorded highest water use efficiency of 4.66 and 7.01 kg.ha mm^{-1} respectively during monsoon, 1990 and summer, 1991 owing to greater moisture retention and higher groundnut pod yields as compared to farm yard manure incorporation.

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(Received : March 1994 Revised : December 199

Madras Agric. J., 82(5): 344-347 May, 1995

GENOTYPE - ENVIRONMENT INTERACTION AND GENOTYPIC CORRELATIONS UNDER DIVERSE ENVIRONMENTS IN GROUNDNUT

M.KANDASWAMI, M.KADAMBAVANASUNDARAM, and G.SOUNDARAPANDIAN

School of Genetics, Tamil Nadu Agricultural University, Coimbatore 641 003

ABSTRACT

Fifteen groundnut genotypes were evaluated for their stability under eight environments. The magnitude of genotype environment interaction was low under rainfed conditions compared to irrigated conditions. Significant positive genotypic correlations obtained in the locationwise and seasonwise analysis indicated that the genes acting under rainfed conditions are similar in the particular location or season. Negative correlation coefficients indicated that the set of genes that acted under one location in irrigated conditions were not similar to that acted under irrigated conditions at another location. To realise optimum yield potential in groundnut ideal genotypes are to be identified suited to different locations as well as to different seasons as the set of genes operating under those conditions appear to be similar.

KEY WORDS : Groundnut, Stability, G x E Interaction, Correlation co- efficient

Seventy per cent of groundnut cultivation in India is confined to *kharif* season and remaining to irrigated *rabi* and summer seasons. There are striking year to year fluctuations in production which can be attributed to instability of genotypes, uncertainities of rainfall and moisture availability at critical growth phases, poor agronomy, pest and disease susceptibilities of cultivars in the rainy season (Swarnalata *et al.*, 1984). Many workers in groundnut reported presence of g x e interaction; it may mean that the best genotype in one environ ment may not be the best in another environment.

In this paper an attempt has been made to find out whether specific difference of environment had any effects on some genotypes than others: or whether there exist a change in the order or merit of a series of genotypes when measured under diffe rent environments and same sets of genes operate in different environments. as suggested by Comstock (1977). Falconer (1983) and Baker (1984).

MATERIALS AND METHODS

Fifteen genotypes developed in the research stations of Tindivanam, Vridhachalam, Bhavani sagar, Aliyarnagar and Coimbatore of Tamil Nadu Agricultural University were studied in three locations *viz.*, Paiyur, Tindivanam and Vridhachalam under irrigated conditions during 1984 (summer) and the same genotypes studied under rainfed conditions (*kharif*) in Tindivanam and Vridhachalam. Five different dates of sowings formed different environments. The genotypes were raised in three rows of 2 m long, adopting 30 cm between rows and 10 cm in the row, Uniform stand was maintained and standard recommended package of practices adopted.

The yield data of pod/plot were grouped as follows:

1. i. Irrigated sowings (Environment 1,2 and 3) 12 genotypes
   ii. Rainfed sowings (E4-E8) 3 replications