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Observing The Effects of Irrigation and Integrated Nutrient Management on Yield Parameters of Sunflower (*Helianthus annuusL.*) in Coastal Saline Soil Condition

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Abstract—*Sunflower (Helianthus annuus L.) is becoming an increasingly important source of edible vegetable oil throughout the world because of its high polyunsaturated fatty acid content and no cholesterol. The increasing demand for this oil may promote increased hectare of sunflower in India as well as the whole world, where some soils are saline or have the potential to become so. The objectives of the present field study conducted in clay loam soil coastal ecosystem were to assess the growth, specially the seed yield and oil yield of Sunflower (Helianthus annuusL.) Despite a wealth of published research on salinity tolerance of plants, neither the metabolic sites at which salt stress damages plants nor the adaptive mechanisms utilized by plants to survive under saline conditions are well understood. The results of the study showed that the crop responded positively to the high frequency of irrigation application and integration of organic and inorganic nutrient addition. However, three irrigation scheduling at buttoning, flowering and seed filling stages with combined application of organic and inorganic nutrient sources (50% NPK + 50% FYM) observed higher values of plant height, number of leaf per plant, diameter of floral head, weight of floral, seed yield, oil content and oil yield. Application of 100% NPK was found moderate and 100% FYM were least in promoting the growth, yield parameters and seed and oil yield of crop. The estimated optimum water requirement for sunflower was 138 mm per season applied at buttoning and seed filling stages, which was essential for achieving higher seed yield of 21 q/ha and water use efficiency of 18.42 kg/ha-mm. In this review, the possibility of using these biochemical characteristics as selection criteria for salt tolerance is discussed. It is concluded that although there are a number of promising selection criteria, the complex physiology of salt tolerance and the variation between species make it difficult to identify single criteria. Progress is more likely if biochemical indicators for individual species rather than generic indicators can be determined. It is found that there is great variation of salt tolerance in sunflower. Low uptake of Cl^-, high uptake of K^+, and maintenance of high K: Na ratios and K^+ versus Na^+ selectivity in the leaves and possibly the accumulation of organic osmotica such as soluble carbohydrates, soluble proteins, proline and free amino acids seem to be the important components of salt tolerance in sunflower.*

Keywords: *yield of crop, irrigation scheduling, oil yield, integrated nutrient management*

INTRODUCTION

The quality of soil is a main factor influencing the land use in agriculture and the sustainable development of farming systems. Sunflower is the second most important oil seed crop next to soybean. In the coastal ecosystem, the net cultivated area is about 0.9072 Mha contributing 52%of the geographical area with cropping intensity of 151%.This salt affected area under study generally hover around rain fed and rice as a monocrop, mostly rain fed rice during wet season. During the dry season, land mostly remain fallow due to lack of good quality irrigation water and soil-salinity. Salinity decreased (N, P & K) content and uptake in leaves of sunflower. Mn, Zn and Fe level was decreased, whereas that of Na and Cl was increased in leaves and seeds of the plants. The changes in macro- and micronutrients under salinity might result from salinity effect on nutrient availability, competitive uptake or partitioning within leaves and seeds. In the present case, Field plot study was initiated to determine the effects of both soil quality and soil depth on growth, seed and oil yield of sunflower *(Helianthus annuus* L.)Grown under increasing levels of soil salinity.

OBJECTIVES OF THE STUDY:

1. To assess the effect of different levels of irrigation and integrated nutrients on growth Parameters, seed and oil production of sunflower.
2. To compute the water requirement and water use efficiencies of crop under the influence of varying levels of irrigation and nutrient sources.

MATERIALS AND METHODS:

Experimental Area:

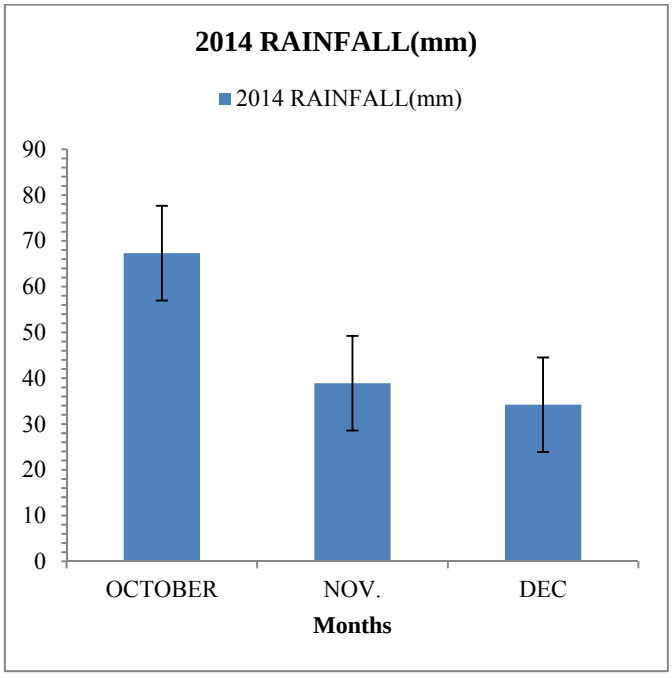
The experimental farm is situated in KAAKDWIP, AKSHAYANAGAR BLOCK, and DISTRICT- SOUTH 24 PARGANAS. It comes under sub-tropical region. The area lying between 21◦32' -22 40'N latitude & 87 30'-89 E. The Rea is potentially productive, but due to shallow ground water table, concave topography, high rainfall, occasional floods, and frequent cyclone and impeded drainage system with salinity hazards agriculture production of the area is adversely effected.

Climate:

1. Dry and warm (March to May)
2. Wet and warm (June to October) and
3. Dry and cool (November to February)

Table 1: Rainfall data at the experiment site during the experimental period:

2014	
MONTH	**RAINFALL(mm)**
OCTOBER	67.3
NOVEMBER	38.9
DECEMBER	34.2
2015	
MONTH	**RAINFALL(mm)**
JANUARY	2.8
FEBRUARY	6.8
MARCH	3.1
TOTAL	153.1



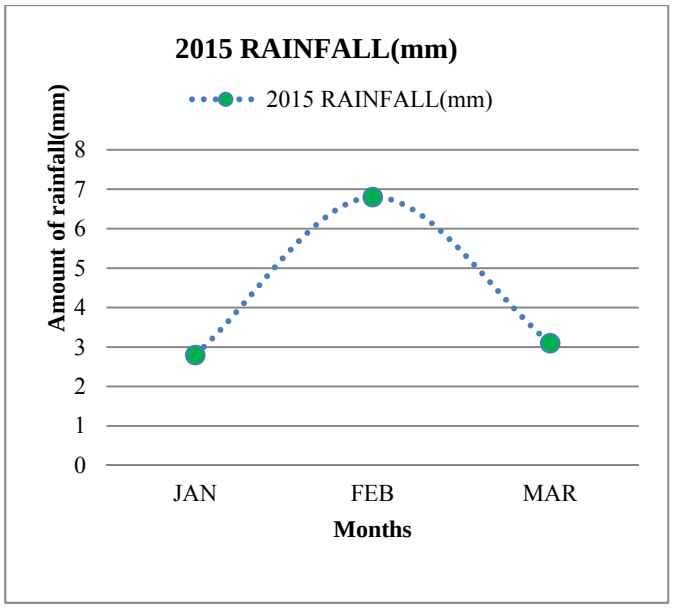


Figure1

TREATMENT DETAILS

- Crop: Sunflower
- Variety: Ganga-Kaveri
- Spacing: 45cm x 25cm
- Plot size: 4m x 3m
- Treatments: Twelve (12)
- Experimental Deign: Split Plot
- Replication: 3

TREATMENT COMBINATION:

Main Plots (Irrigation Level):

- I_1: Rainfed,
- I_2: Irrigation at buttoning
- I_3: Irrigation at buttoning and seed filling

I_4:Irrigation at buttoning, flowering and seed filling

Sub plots (fertility Level)

- N_1 :100% NPK
- N_2 :50%NPK +50%FYM
- N_3 :100%FYM

OBSERVATIONS:

Crop Parameters: Here we are taking only the yield parameters.

Yield:

I. Seed yield (q/ha)

ii. Oil (%)

Iii.Oil yield (q/ha)

Experimental Details:

- The layout of the experiment was conducted in Split Plot Design.
- Total number of treatments were 12 which were replicated thrice. The size of an individual plot was 4mX3m.
- Total number of plots were 36. The variation due to irrigation was kept in the main plots and variation due to nutrient doses was kept in sub-plots.

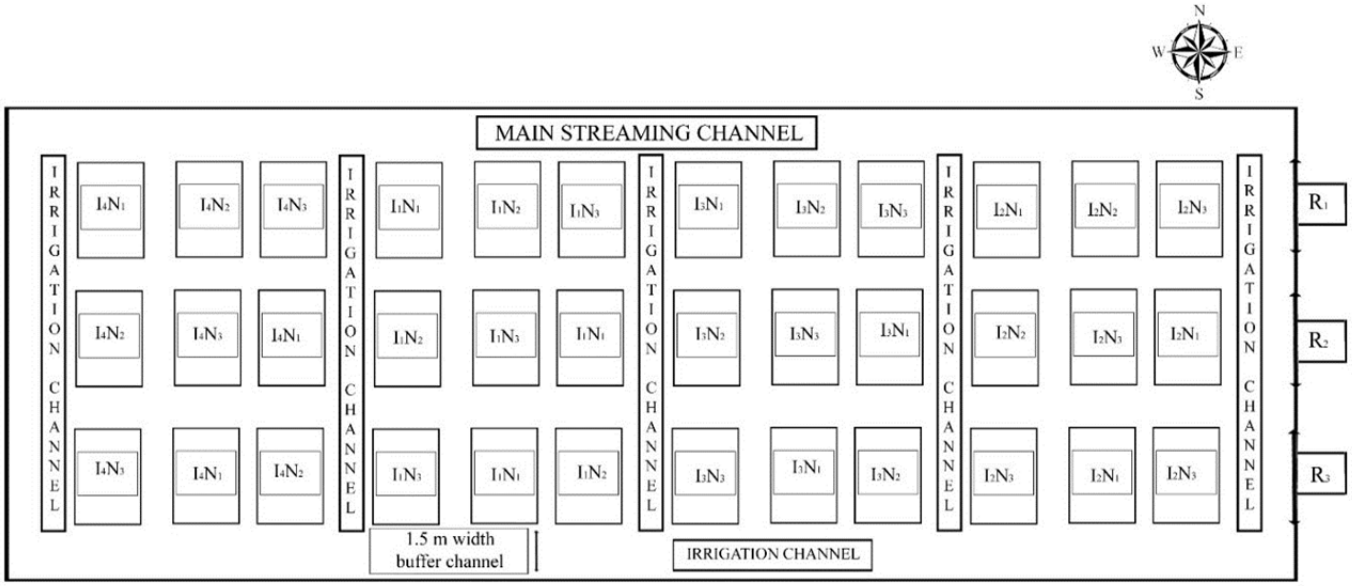


Table 2: Treatment Combinations of Experiment:

$T_1= I_1N_1$	$T_7= I_3N_1$
$T_2= I_1N_2$	$T_8= I_3N_2$
$T_3= I_1N_3$	$T_9= I_3N_3$
$T_4= I_2N_1$	$T_{10}= I_4N_1$
$T_5= I_2N_2$	$T_{11}= I_5N_2$
$T_6= I_2N_3$	$T_{12}= I_4N_3$

Here, I_1 = Rainfed

I_2= Irrigation at branching

I_3 = Irrigation at branching and pod development

I_4 = Pre flowering and pod development; and three subplot of different fertilizer level *i.e.* 100% NPK ($N_{1)}$, 50%NPK +50%FYM (N_2) AND 100%FYM (N_3).

- The net plot size was 4mX3m leaving 0.5m width of bund and 1.0m irrigation channel.
- In case of fertilizer application, the Recommended doses of 60:30:30 n, P_2O_5 and K_2O/ha were administered as Urea, Single Superphosphate and Muriate of Potas, respectively. Half of Nitrogen was applied as basal and remaining half as top-dressing at 40-45 DAS. Full dose of phosphorous and half potassium were applied as basal and the remaining half K was top dressed at 40-45 DAS.In case of organic nutrient management, well decomposed FYM containing 0.6% N, 0.3% P2O5 and 0.8% K_2O on dry weight basis applied as basal during the final land preparation.
- The crop cultivar cv. Ganga – Kaveri was sown at a spacing of 45 cm X 25cm on 21st December 2014 and was harvested on 25th April 2015.

Table 3: Components of Water Balance, Water Use and Water Use Efficiency of Sunflower under Different Levels of Irrigation and Nutrient Application:

Treatment	Soil profile contribution (mm)	Effective rainfall (mm)	Irrigation applied (mm)	Water use* (mm)	Seed yield (kg/ha)	Water use efficiency (kg/ha-mm)
Irrigation level (I)						
I_1	20.5	19.2	0.0	59.7	1163.3	19.43
I_2	19.6	19.2	40.0	98.8	1693.3	17.13
I_3	18.7	19.2	80.0	137.9	2096.7	15.20
I_4	17.4	19.2	120.0	176.6	2236.7	12.66
Nutritional level (N)						
N_1	19.7	19.2	60.0	118.9	1912.5	17.16
N_2	19.1	19.2	60.0	118.3	2102.5	19.19
N_3	18.4	19.2	60.0	117.6	1377.5	11.97
Irrigation x *Nutrition (I* x *N)*						
$I_1 N_1$	21.3	19.2	0	60.5	1270	20.99
$I_1 N_2$	20.6	19.2	0	59.8	1500	25.08
$I_1 N_3$	19.7	19.2	0	58.9	720	12.22
$I_2 N_1$	20.4	19.2	40	99.6	1780	17.87
$I_2 N_2$	19.5	19.2	40	98.7	1910	19.35
$I_2 N_3$	18.8	19.2	40	98.0	1390	14.18
$I_3 N_1$	19.2	19.2	80	138.4	2410	17.41
$I_3 N_2$	18.7	19.2	80	137.9	2540	18.42
$I_3 N_3$	18.1	19.2	80	137.3	1340	9.76
$I_4 N_1$	17.9	19.2	120	177.1	2190	12.37
$I_4 N_2$	17.6	19.2	120	176.8	2460	13.91
I_4N_3	16.8	19.2	120	176.0	2060	11.70

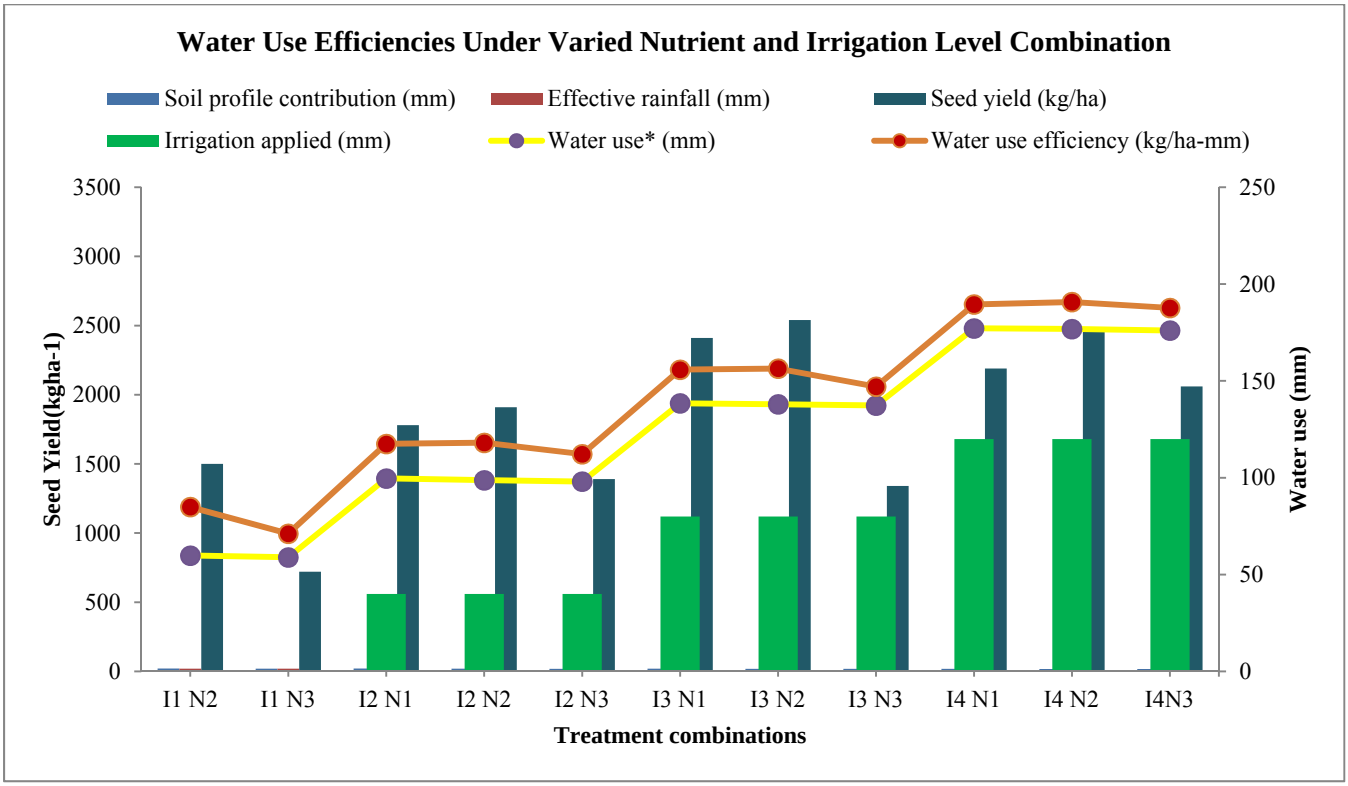


Figure 2

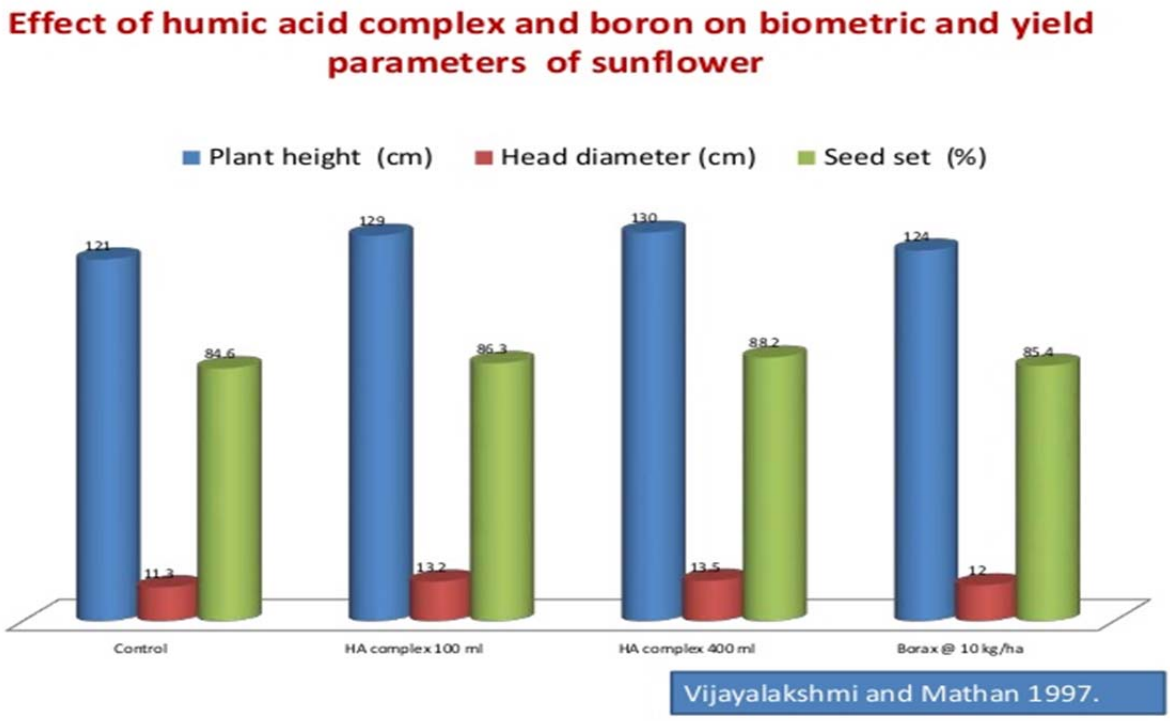


Figure3

Table 3: Effects of Different Levels of Irrigation and Nutrients On the Seed-Yield (Qha^{-1}) Of Sunflower in A Coastal Soil:

Irrigation vs. Nutrients	I_1	I_2	I_3	I_4	MEAN
N_1	12.7	17.8	24.1	21.9	19.1
N_2	15.0	19.1	25.4	24.6	21.0
N_3	7.2	13.9	13.4	20.6	13.8
MEAN	11.6	16.9	20.9	22.4	-
	I	N	IXN	NXI	
SEm (±)	0.10	0.18	0.37	0.45	
CD (P=0.05)	0.32	0.55	1.11	0.96	

RESULT AND DISCUSSIONS:

- The field experiment was conducted during the winter season of 2014-15 with a view to study the effects of various irrigation levels and integrated nutrient management on the seed yield and oil-content of Sunflower in coastal saline soil condition.
- The seed yield of sunflower was influenced significantly due to scheduling of irrigation water, Integrated Nutrient management and their interactions.
- TheThe highest growth and production of sunflower were observed under I_4 irrigation scheduling and N_2 fertility level as well as interaction level I_4N_2.
- Thus the best combination of three irrigations at buttoning, flowering and seed filling with 50%NPK and 50%FYM fertilizer application
- Therefore, an effective nutrient management (F_2) might be an option of scarce and limited irrigation water i.e. one irrigation is at buttoning could save one post-sowing irrigation without compromising the yield of this crop in the event of limited irrigation water**.**

CONCLUSION:

In a nutshell, it may be concluded that Sunflower responded positively to the high frequency of irrigation and organic and inorganic sources of plant nutrient application. Some important key points are as follows:

- The higher amount of water application by conventional surface irrigation is not always conducive for higher marketable seed production.
- On the contrary, precise amount of water application in two splits each at a depth of 40mm in buttoning and seed filling stage is much beneficial in promotion of healthy plant growth and higher seed yield of sunflower in coastal clay loam soil.

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