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Yield, water use and economics of sunflower (*Helianthus annuus*) as influenced by irrigation and integrated nutrient management

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Abstract
Field experiment was conducted at AICRP on Water Management, Belavatagi, UAS, Dharwad, during 2013-14 to 2014-15 on soil deficient in available micronutrient to study the **"**Yield, water use and economics of sunflower (*Helianthus annuus*) as influenced by irrigation and integrated nutrient management. The crop receiving irrigation level at 0.8 IW/CPE recorded significantly higher sunflower yield (18.14 q/ha), gross income (Rs.58, 968 /ha), net income (Rs.43,593) B: C ratio (3.84) during 2013.However, such significance was not observed during 2014 and in pooled analysis. Among different nutrient combinations, RPP (RDF+ FYM) treatment also recorded higher gross returns (Rs. 69,247) and net returns (Rs.50,519) B:C ratio (3.73) and WUE (5.97) in pooled analysis. The interaction effect between irrigation and nutrient level showed that, the treatment received RPP with 0.8 IW/CPE recorded significantly higher grain yield (21.5 q/ha) and economics. The higher B:C ratio (3.94) and WUE (6.37 kg/ha. mm) was observed with irrigating at critical stages with RPP treatment combinations.

Keywords: Irrigation levels, integrated nutrient management, growth, yield, sunflower

Introduction
Due to serious water shortages the great challenge for the coming decades is the task of increasing food production with less water, particularly in countries with limited water, land resources. Therefore, techniques are needed to increase the water use efficiency. Irrigation scheduling and nutrient management has conventionally aimed to achieve an optimum water supply to crop for enhancing the productivity, with soil water content being maintained close to field capacity. In Soil moisture content plays an important factor of crop production and because of non-judicious application of water; method of irrigation, considerable amount of water is being loosed by seepage and percolation below the root zone leading to loss of some valuable plant nutrients through leaching process. Water stress during the yield period leads to reduction in yield as compared to full irrigation as shown by Tolga and Lokman, 2003 [1]. The increasing worldwide shortages of water and costs of irrigation are leading to an emphasis on developing methods of irrigation that minimize water use and maximize the water use efficiency in crop. The optimization of irrigation water to crop at particularly when there is insufficient amount water for crop demand is essential for irrigation water management. However, with good planning, design and operation of irrigation schemes as reported by Ramamoorthy *et al.* (2009) [2]. Nutrient supply or application is a key factor of crop production but the global crises of energy and food due to escalation in the price of chemical fertilizers; a greater emphasis has to be made on supplementing the chemical fertilizers with less priced sources of nutrients such as organics and bio-fertilizers. Integrated nutrient supply of nutrients is known to improve water use efficiency, physical conditions of soils and provide balanced nutrition package to the crop. Therefore, keeping the above said points in view, an experiment will be laid on the nutrients management practices in sunflower under varied irrigation levels in a *Vertisol* of Malaprabha Command Area".

Methodology
A field experiment was conducted at AICRP on Water Management,Belvatagi, University of Agricultural Sciences, Dharwad, during 2013-14 and 2014-15.The *vertisols* of Malaprabha command area is deficit in micronutrients particularly zinc (< 0.57 ppm), iron (< 4.10 ppm) and boron (< 0.12 ppm) due to calcareous nature of soils(soil properties are given in Table 1). The experiment was laid out in split plot design with three replications. The experiment site was calcareous in nature and soil was clay in texture, alkaline in reaction, normal in salt

content, low in available nitrogen, medium in available phosphorus and sulphur and high in available potassium content, Soil was high in DTPA extractable Cu, Zn and Mn but deficient in Fe. The Experiment was laid out in split-plot design with three replications. The treatments are main plot consists of three irrigation levels (I1= 0.6 IW/CPE and I2= critical stages) and the total amount of water applied during *kharif* 2013-14 (I1- 525.6 and, I2- 465.8) and 2014-15 (I1- 240, I2- 180). Sub plot: Five micronutrients combination (N1 - 75% N through organics, N2 - 100% N through organics, N3 - 100% Inorganic's,N4 - Integrated N (50% organics + 50% Inorganics) and N5- RPP (RDF+ FYM). The sunflower (Sunbread-207) crop was sown at a spacing of 60x20 cm in a gross plot size of 4.8 m x 3.6 m. All organic and inorganic manures were applied to respective treatment plots 15 days prior to sowing However, RPP is comprises of 90 kg N: 90 kg P2O5: 60 kg K2O: 10 kg ZnSO4 ha-1 + 0.5% borax spray at ray floret stage + FYM @ 8 t ha-1 + *Azospirillum*- 500 g/ha.

Table 1: Physical and chemical characteristics of the experimental soil

Properties	**Values**
Soil type	Chromustert
Soil	Clay
pH	8.30
O.C	0.51%
Av. P_2O_5	31 kg/ha
Av. K_2O	791 kg/ha
F.C.	38.0%
PWP	20.0%

Results and Discussion

Soil moisture directly influences the availability of nutrients for plants. The data on irrigation and integrated nutrient management levels (applied through both organic as well as inorganic sources) are presented in table. Views extrapolated from the results revealed that the levels of irrigation significantly influenced the seed yield of sunflower. The crop receiving irrigation level at 0.6 IW/CPE recorded significantly higher sunflower yield (18.14 q/ha), gross income (Rs.58, 968 /ha), net income (Rs.43,593) B: C ratio (3.84) during 2013. However, application of higher but optimum frequency of irrigation was associated with an increase in accumulation and distribution of assimilates in the plant parts from seedling to the maturity stage. However, such significance was not observed during 2014 and in pooled analysis compared to other treatment (Table 2 & 3). However, during 2013, 2014 and in pooled analysis, the yields were on par with different irrigation levels. The results confirm the findings of Shinde*et al.* (2014) [9]. Irrigation scheduled at 0.75 IW/CPE ratio compared with irrigation scheduled at CGS, owing to improvement in important growth and yield attributes. Therefore, irrigation to maize with 0.75 IW/CPE ratio is good for higher grain yield. The results (seeds as well as oil yield and its content) were in conformity with the findings of some research workers (Mandal and Giri, 2002) [3]. In rest of the years, rainfall received was sufficient to meet the moisture requirement of sunflower. Since the requirement of sunflower in Northern Dry Zone of Karnataka is 500-600 mm (Anon., 2011) [1]. Minimum values of all the characters were obtained from the plants that grown under rainfed condition (W0). The moisture stress condition resulted in no irrigation over moisture saturated condition reflected on the yield variables (Taha *et al.*, 2001) [10]. Among different nutrient combinations, RPP (RDF+ FYM) recorded significantly higher yield during both the years and in pooled analysis also (Table 2 and 3). The former treatment also recorded higher gross returns (Rs. 69,247) and net returns (Rs.50,519) B:C ratio (3.73) and WUE (5.97) in pooled analysis. However, lower seed yield (14.4 q/ha**)** was noticed in 75% N through organics. Nanjundappa *et al*., (2001) [4]. reported that, increase in growth and yield attributes may be due to adequate supply of nutrients and soil moisture resulted in higher production of photosynthate and translocation to sink, which ultimately increased the plant growth and growth attributes. Improvement in yield attributes due to INM resulted in a significant increase in the ultimate grain yield of sunflower (Reddy and Reddy, 2002) [7]. Immediate release of N through urea and the latter by the mineralization of N through vermicompost resulted steady supply of nutrients throughout the crop growth period (Kavitha and Swarajya Lakshmi, 2003) [2]. The results were also in accordance with works of some workers (Vanja and Raju, 2004) [12]. The percentage of yield increment (seeds) in N1 over other treatments was to the tune (Table 2). Moreover, integration of organic manure with chemical fertilizers improved the oil content of sunflower, probably due to addition of sulphur besides other major and micronutrients, opined with the their works (Kavitha and Swarajya Lakshmi, 2003) [2]. The interaction effect between irrigation and nutrient level showed that, the treatment received RPP with 0.6 IW/CPE recorded significantly higher grain yield (21.5 q/ha), gross returns (Rs.69,433), net returns (Rs 50,683). The increased in test weight and biological yield of crop with the higher frequency of irrigation might be due to better growth of the crop, higher dry matter production and better translocation of source to sink, resulted in higher grain yield. On the contrary, the lower test weight with decreased in frequency of irrigation might be due to moisture stress leading to poor translocation of photosynthates to grain resulting in small sized and shriveled grains as reported by Puste *et al.* (2013) [5]. Economics is the most important phenomenon to judge the best one among the treatment variables that have the opportunity to accept for its further adaptation and is the utmost factor, which should be considered for the implementation of any resultant beneficial outbreak of any viable finding at farmers' level. It includes the cost of production, gross profit, net profit and ultimately, benefit-cost ratio (BCR) of the system. The higher B:C ratio (3.94) was observed with irrigating at critical stages with RPP treatment combinations. Based on the market value of the produce, all were calculated and from the calculation, it might thus possible to evaluate for economic consideration for adaptation of suitable-agro-techniques for the benefit of the rural sector of the zones as a whole. Gross monetary return, net return as well as B-C ratio was remarkably influenced both by the INM as well irrigation regimes applied on sunflower. Highest values of gross return (INR 69,060 ha^{-1}) and net profit (INR 50,683 ha^{-1}) had gone in favour of N_5: RPP (RDF+ FYM) treatment. The WUE (6.37 kg/ha. mm) was observed with irrigating at critical stages with RPP treatment combinations (Table 3). The results indicated that increase in irrigation increased the seasonal water use. In general, irrigation increased reserve soil-moisture content, which improved the water status and plant growth. Thus, higher rate of water flow from the soil via plant to atmosphere due to less stomatal resistance and more leaf area, which helped to sustain better transpiration rate in sunflower, improved the the yield of sunflower and this was conformity with the findings of workers (Singh *et al.*, 2000) [8].

Table 2: Grain yield (q ha^{-1}) and economics of sunflower as influenced by irrigation and integrated nutrient management (during the years 2013 & 2014 (pooled data of 2 years).

Treatments	Sunflower yield (q/ha)			Gross returns (Rs/ha)			Net returns (Rs/ha)		
	Irrigation levels (I)			Irrigation levels (I)			Irrigation levels (I)		
	0.6 IW/CPE	Critical stages	Mean	0.6 IW/CPE	Critical stages	Mean	0.6 IW/CPE	Critical stages	Mean
N1 = 75% N through organics	14.9	14.0	14.4	47,668	47,246	47,457	34,651	34,196	34,424
N2 = 100% N through organics	16.1	15.3	15.7	51,509	51,895	51,702	34,634	35,336	34,985
N3 = 100% Inorganic	19.0	18.4	18.7	61,549	58,714	60,131	43,999	41,193	42,596
N4 = (50% organics + 50% in organics)	18.1	17.5	17.8	58,184	58,834	58,509	42,834	43,800	43,317
N5 = RPP (RDF+ FYM)	21.5	20.6	21.0	69,433	69,060	69,247	50,683	50,354	50,519
Mean	17.9	17.2		57,668	57,150		41,360	40,906	
Sources	S.Em+		C.D(P=0.05)	S.Em+	C.D(P=0.05)		S.Em+	C.D(P=0.05)	
Main plot (I)	0.8		NS	1,727	NS		1,326	8,070	
Sub plot (F)	0.5		1.4	1,800	5,395		2,267	6,797	
M X S	0.7		2.0	2,545	7,630		3,206	9,613	

Table 3: B-C ratio and WUE kg/ha mm of sunflower as influenced irrigation and integrated nutrient management during the years 2013 & 2014 (pooled data of 2 years).

Treatments	B:C			WUE kg/ha mm		
	Irrigation levels (I)			Irrigation levels (I)		
	0.6 IW/CPE	Critical stages	Mean	0.6 IW/CPE	Critical stages	Mean
N1 = 75% N through organics	3.63	3.63	3.63	3.63	4.25	3.94
N2 = 100% N through organics	3.07	3.24	3.15	3.90	4.72	4.31
N3 = 100% Inorganic	3.53	3.63	3.58	4.62	5.67	5.15
N4 = (50% organics + 50% in organics)	3.82	3.94	3.88	4.34	5.38	4.86
N5 = RPP (RDF+ FYM)	3.72	3.74	3.73	5.22	6.37	5.79
Mean	3.55	3.64		4.35	5.27	
Sources	S.Em+	C.D(P=0.05)		SE	CD at 5%	
Main plot (I)	0.09	0.53		0..25	0.71	
Sub plot (F)	0.12	0.37		0.36	1.03	
M X S	0.17	0.52		0.45	1.34	

Conclusion

The irrigation scheduling at 0.6 IW/CPE and soil application of RPP (RDF+ FYM) has recorded higher yield, economics and WUE(Kg/ha-mm) and yield attributes as compared to other treatments and this was found most effective and ideal for increasing productivity of sunflower.

References

1. Anonymous Annual Report All India Co-ordin`ated Research Project on Water Management, Belvatagi, University of Agricultural Sciences, Dharwad, 2011.
2. Kavitha P, Swarajya Lakshmi G. Effect of conjunctive use of nitrogen sources on seed yield, soil-physici-chemical properties and available macronutrients status in sunflower. The Andhra Agric. J. 2003: 50(1 and 2):38-42.
3. Mandal B, Giri G. Influence of irrigation and nutrients on growth, yield and oil content of spring sunflower (*Helianthus annuus* L.). Indian J Agron. 2002: 47(2):255-261.
4. Nanjundappa G, Shivraj B, Janarjuna B, Sridhara S *et al*. Effect of organic and inorganic sources of nutrients applied alone or in combination on growth and yield of sunflower (*Helianthus annuus* L.). Helia. 2001: 24(34):115-120.
5. Puste AM, Nath R, Pinto B, Moitra A, Mandal TK *et al*. Influence of integrated nutrient management and irrigation on soil and plant nutrient concentration of summer sunflower. Indian journal of agriculture science. 2013; 47(3):238-242.
6. Ramamoorthy K, Murali A, Subbian P. Effect of irrigation scheduling and method of irrigation on productivity and water economy in hybrid sunflower (*Helianthus annuus* L.). Helia. 2009; 32(50):115-122.
7. Reddy PVRM, Reddy CKR. Yield and yield attributes of sunflower (*Helianthus annuus* L.) as influenced by integrated nutrient management. The Andhra Agric. J. 2002; 49(1 and 2):41-44.
8. Singh M, Singh H, Singh T, Jhorar RK, Singh BP, Singh H *et al*. Seed yield, water use and water use efficiency of sunflower (*Helianthus annuus* L.) genotypes under irrigation variables. Indian J Agron. 2000; 45(1):188-192.
9. Shinde SA, Patange MJ, Dhage SJ. Influence of irrigation schedules and integrated nutrient management on growth, yield and quality of rabi maize (*Zea mays* L.) Int. J Curr. Microbiol. App. Sci. 2014; 3(12):828-832.
10. Taha M, Mishra BK, Acharya N. Effect of irrigation and nitrogen on yield and yield attributing characters of sunflower. Annals Agric. Res. 22(2):182-186.
11. Tolga E, Lokman DAHO. Water use characteristics of sunflower (*Helianthus annuus* L.) under deficit irrigation Pakistan J of Biological Sciences. 2001; 4(7):766-769.
12. Vanja M, Raju AS. Residual effect of organic, bio and inorganic sources of nutrients on sunflower in rice-sunflower cropping system. J Soils and Crops. 2004; 14(2):237-246.