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Effect of mulching and irrigation on the yield of okra

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Abstract: The experiment was conducted at the MLT site, Dacope, Khulna during 2011-12 and 2012-`13 in kharif 2 season. The experiment was laid out in randomized complete block design with 3 replications using eight treatment combinations viz. T_1: No irrigation with mulch, T_2: No irrigation without mulch, T_3: Irrigation at vegetative stage with mulch, T_4: Irrigation at vegetative stage without mulch, T_5: Irrigation at vegetative + flower initiation stages with mulch, T_6: Irrigation at vegetative + flower initiation stages without mulch, T_7: Irrigation at vegetative + flower initiation + 20 days after flower initiation stages with mulch, T_8: Irrigation at vegetative + flower initiation + 20 days after flower initiation stages without mulch. The highest yield (13.82 t/ha and 12.77 t/ha) was recorded from the treatment T_7, where irrigation was applied at vegetative + flowering + 20 days after flower initiation stages with mulch against the lowest yield (10.05 t/ha and 9.75 t/ha) recorded in T_2 treatment, where neither irrigation nor mulch was used.
Key words: Mulching, irrigation, salinity and okra.

Introduction

Okra (*Abelmoschus esculentum* L.) is an annual herb and vegetable crop grown throughout the tropical and subtropical parts of the world either as the sole crop or intercrop with maize or another (Emuh *et al.*, 2006; Thakur and Arrora, 1986). Okra plays an important role in the human diet by supplying carbohydrate, protein, fats, minerals and vitamins that are usually deficient in the staple food. The nutritional importance of okra pod has reawakened interest in bringing the crop into commercial production. Despite the nutritional value of okra, its avarage yield is only 3.0-3.2 t/ha (Rashid, 1999) and quality have not been attained in the tropical countries partly because of a continued decline of soil fertility. Okra plant requires warm temperatures and unable to tolerate low temperature for long time. The optimum temperatures are in the range of 21-30^{o}C with minimum temperatures of 18^{o}C and maximum of 35^{o}C. Okra is a high water use crop despite having considerable drought resistance. The plant forms a deeply penetrating tap root with dense shallow feeder roots reaching out in all directions. For higher yield and relatively moist soils are required during the total growing period. Reduction of water supply during the growing period in general has an adverse effect on yield and the greatest reduction of yield occurs when there is a continuous water shortage until the time of first picking. Soil moisture is the most limiting factor for crop production in the saline areas. Soil salinity starts from November and reaches up to pick in June to July. But soil moisture can be conserved by mulching. This can reduce irrigation frequency and amount of water. Research shown that mulch provides many benefits to crop production through soil and water conservation, enhance soil biological activity and improved chemical and physical properties of soil (Cooper, 1973). Besides, mulch reduces soil salinity considerably by reducing capillary rise and evaporation of soil moisture. Menezes *et al*. (1974), Chung (1987) and Aliudin (1986) reported that mulches conserved more soil moistures, enhances vegetative growth and yield contributing characters of garlic. Farmers in this area irrigate their crops from mini pond, locally known as *kuni.* Water of *kuni* is almost non-saline. Having these information, an attempt was made to undertake the present experiment to find out the effect of mulch along with suitable stage of irrigation during the crop growing period to maximize the yield of okra in the region.

Materials and Methods

The experiment was conducted at the MLT site, Dacope, Khulna during *kharif*-2 season, 2011-12 and 2012-`13.The experiment was laid out in randomized complete block design with 3 replications. There were eight treatment combinations viz. T_1: No irrigation with mulch, T_2: No irrigation without mulch, T_3: Irrigation at vegetative stage with mulch, T_4: Irrigation at vegetative stage without mulch, T_5: Irrigation at vegetative+ flower initiation stages with mulch, T_6: Irrigation at vegetative + flower initiation stages without mulch, T_7: Irrigation at vegetative + flower initiation + 20 days after flower initiation stages with mulch, T_8: Irrigation at vegetative + flower initiation + 20 days after flower initiation stages without mulch. Straw was used as mulch materials and thickness of mulch was 15 cm. Okra variety '*Shomi'* was used in the experiment. The unit plot size was 3.0 × 2.8 m. The land was fertilized with 69-20-75 kg of NPK/ha in the form of urea, TSP and MOP. All the fertilizers except urea were applied as basal during final land preparation. Urea was top dressed in three equal splits at 20, 35 and 60 days after sowing. Seeds of okra were sown on 15 March, 2012 and 20 February 2013 at 60 × 40 cm spacing. The crop was irrigated 7-8 times from surface water of *kuni* as per requirement of the crop and salinity of the *kuni's* water was recorded. Weeding was done four times. No major disease and insect infestation was observed. Harvesting was continued from 07 June-7 July,2012 and 07 April-31 May 2013. The yield and yield contributing characters were recorded from randomly selected 10 plants and the data were analyzed statistically. Treatment means differences were calculated by Duncan's Multiple Range Test (Gomez and Gomez, 1984). Soil salinity of the experimental plot and rainfall were recorded during crop growing period. Soil salinity was measured using EC meter (HANNA Model Hl 8033) calibrated with 0.01M KCI at 25^o C (Peterson, 2002).

Results and Discussion

Yield and yield components of okra as influenced by different treatments are presented in Table 1 & 2, separately for 2011-12 and 2012-13.

2011-12: The highest yield of okra (13.82 t/ha) was recorded from T_7 (Irrigation at vegetative + flower initiation + 20 days after flower initiation stages with mulch). It might be due to its highest plant height (104.20

cm), number of fruits/plant (42.13) and fruit wt./plant (1143.33 g). The second highest yield (12.86 t/ha) was obtained from T_8 (Irrigation at vegetative + flower initiation + 20 days after flower initiation stages without mulch). It was statistically identical with the yield of T_7. The lowest yield (10.05 t/ha.) was found from T_2 (No irrigation without mulch), which was probably due to the lowest number of fruit plant (32.87), fruit wt./plant (830 g) and higher number of mortality (24.76%). The salinity was measured 2.19-7.56 dS/m during crop growing period (Table 1 and Figs. 1-2).

Table 1. Yield and yield contributing characters of okra as influenced by irrigation and mulch material during 2011-12

Mulch material	Mortality (%)	Plant height (cm)	Fruits /plant	Fruit wt./plant (g)	Yield (t/ha)
T_1	11.43 c	101.97 a	54.00 fg	833.33 d	10.55 d
T_2	24.76 a	82.67 b	32.87 g	830.00 d	10.05 d
T_3	8.57 c	102.12 a	36.03 de	866.67 d	11.90 bc
T_4	19.05 b	92.83 ab	35.50 ef	896.67 cd	11.08 cd
T_5	8.57 c	104.10 a	38.62 bc	1046.67 b	11.98 bc
T_6	20.95 ab	97.37 a	37.52 cd	953.33 c	11.86 bc
T_7	13.33 c	104.20 a	42.13 a	1143.33 a	13.82 a
T_8	20.95 ab	100.35 a	40.03 b	1123.33ab	12.86 ab
LSD(0.05)	4.95	14.01	1.64	80.19	1.12
CV (%)	17.75	8.13	2.52	4.76	5.44

Figures in a column having same letter(s) did not differ significantly.

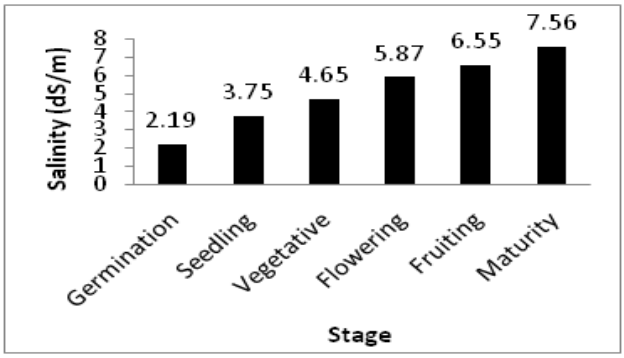

Fig.1. Salinity levels (dS/m) of soil at different growth stages of crops

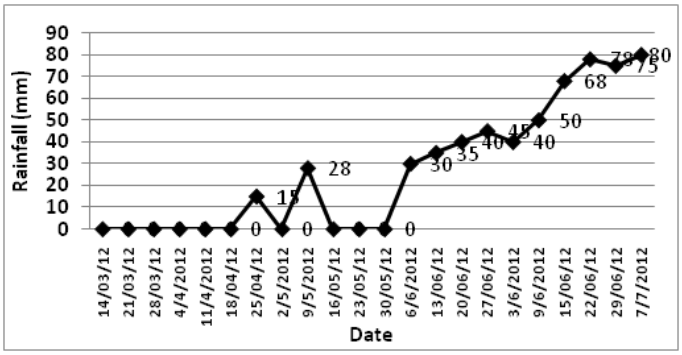

Fig. 2. Weekly rainfall during the crop growing period

2012-13: The highest okra yield (12.77 t/ha) was found in T_7 (Irrigation at vegetative + flower initiation + 20 days after flower initiation stages with mulch). It was probably due to its highest plant height (106.02 cm), number of fruits/plant (40.93) and fruit wt./plant (1117.00g). Statistically similar yield (12.03) was found from T_8 (Irrigation at vegetative + flower initiation + 20 days after flower initiation stages without mulch). The lowest yield (9.75 t/ha.) was found from T_2 (No irrigation without mulch), which was probably due to the lowest number of fruit/plant (32.57), fruit wt./plant (800 g) and higher number of mortality (22.86%). The salinity was measured 2.98-8.78 dS/m during crop growing period (Table 2 and Figs. 3-4).

Table 2. Yield and yield contributing characters of okra as influenced by irrigation and mulch material during 2012-13

Treatment	Mortality (%)	Plant height (cm)	Fruits /plant	Fruit wt./plant (g)	Yield (t/ha)
T_1	8.57 c	101.97 a	33.70 cd	806.7 0 d	10.20 de
T_2	22.86 a	82.67 b	32.57 d	800.00 d	9.75 e
T_3	10.48 bc	102.12 a	35.23 c	843.30 d	11.40 bc
T_4	20.00 a	92.83 ab	35.10 c	875.00 cd	10.88 cd
T_5	11.43 bc	104.10 a	38.27 b	1053.00 ab	11.62 bc
T_6	22.86 a	97.37 a	37.13 b	960.00 bc	11.07 c
T_7	14.29 b	106.02 a	40.93 a	1117.00 a	12.77 a
T_8	20.00 a	100.35 a	38.57 b	1063.00ab	12.03 ab
LSD(0.05)	5.10	14.01	1.80	99.80	8.80
CV (%)	17.88	8.13	2.82	6.06	4.10

Figures in a column having same letter(s) did not differ significantly.

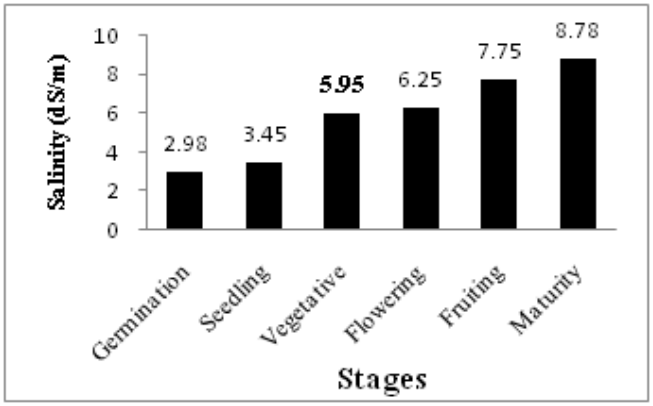

Fig. 3. Salinity levels (dS/m) of soil at different growth stages of crops

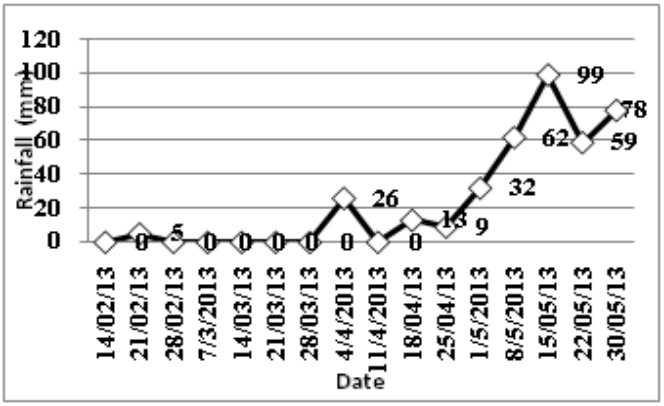

Fig. 4. Weekly rainfall during the crop growing period

The period at the beginning of the flowering is most sensitive to water shortage and soil water depletion in the root zone during this period should not exceed 25%. Water shortage just prior and/or during early flowering reduces the number of fruits (Al-Harbi *et al.* 2008). Besides, mulch is used to cover soil surface around the plants to create congenial condition for the growth. This may include temperature moderation, salinity reduction and weed control. It exerts decisive effects on earliness, yield and quality of the crop (Bhardwaz *et al.* 2012).

Considering higher yield in both the year, it can be concluded that irrigation applied at vegetative + flower initiation + 20 days after flower initiation stages with mulch is the best for cultivation of okra in the coastal saline areas. If mulch is not available for large scale cultivation, irrigation could be applied at vegetative+ flower initiation + 20 days after flower initiation stages without mulch.

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