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Response of Irrigation Levels, Crop Geometry and Mulch on Fruiting and Picking of okra Grown under Drip System

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ABSTRACT: The field experiments conducted to Instructional Farm, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner, for two consecutive *Kharif* seasons in 2018 and 2019 to investigate the "Responce of Irrigation Levels, Crop Geometry and Mulch on Fruiting and Picking of okra (*Abelmoschus esculentus* (L.) Moench) Grown under Drip System". Experiments were set up in a split plot design and repeated three times. In the main plot, four irrigation levels (40, 60, 80, and 100 per cent PE), in the sub-plot, two crop geometry (normal sowing at 50 cm row spacing and paired row sowing at 30 cm × 70 cm) and in the sub-sub plot, three mulch (no mulch, straw, and plastic mulch) were used. Different irrigation levels, crop geometry and mulch treatments all had a significant impact on days to first fruiting and picking of okra, according to the findings. Pooled mean results showed that irrigation at 40 per cent PE were recorded minimum days to first fruiting and fruit picking.

Keywords: Drip Irrigation, Crop Geometry, Mulch, Okra.

INTRODUCTION

Okra popularly known as lady's finger or bhindi is widely adopted and common vegetable in Indian kitchens and can be grown in summer and rainy seasons throughout India. It is originated from tropical Africa and belongs to family malvaceae. It is mainly grown for its tender fruits which are used as a vegetable in various ways. It can be fried or cooked with necessary ingredients. The tender fruit can be cut into small pieces, boil and served with soup. Root and stem are used for clearing cane juice for preparation of jaggery. High iodine content of fruits helps to control goiter while leaves are used in inflammation and dysentery. The dry seed contains 13-22 per cent edible oil and 20-24 per cent protein. The oil is used in soap cosmetic industry and as vanaspati while protein is used for fortified preparations (Chadha, 2013). In India, the area and production of okra is 0.519 million hectare and 6.37 million tonnes, respectively (Anonymous, 2019-20a). In Rajasthan, it is grown in 4278 hectare area with the annual production of 19727 tonnes, which is very less as compared to national average productivity of okra (Anonymous, 2020- 21b). Rajasthan has the largest geographical area having only one percent water resources of country. The major source of water in the state is dug wells and tube wells. Efficient and proper water management system is required in hyper arid zone of Rajasthan where water is scare, temperature remains high for a longer period, retention capacity of the soil is very low and rainfall is erratic with low precipitation. Under such circumstances, micro- irrigation, an efficient approach for irrigation water management has played the most significant role to bring more area under irrigation with the available water and increasing the productivity of crop and water use efficiency (Sivanappan, 2004). Drip system increase water use efficiency by reduced soil evaporation and drainage losses. Its field application efficiency can be as high as 90 per cent compared to 60–80 per cent for sprinkler and 50–60 per cent for surface irrigation Drip irrigation regulates soil moisture, stabilizes soil temperature, suppress weed growth, minimize the leaching losses of nutrients, check excessive evaporation, reduces soil erosion and improves production and quality of crops. The mulching techniques were being used widely in irrigated crop production worldwide. Mulching with drip irrigation system is an effective method of manipulating crop growing environment to increase yield and improve product quality by ameliorating soil temperature, conserving soil moisture, reducing soil erosion, weed control, improving soil structure, enhancing organic matter content and root system development by optimizing the level of nitrogen and carbon dioxide. Producer of okra crops often use different mulching types to suppress weed or conservation of moisture near the root of the crop. Black plastic mulch is the most commonly used plastic mulch for moderating the micro climate around the plants (Dodds *et al.,* 2003; Hanna *et al.,* 2003). The cultivation of okra crop in arid and semi-arid regions is mainly done in rainy season because high

temperature and high wind velocity prevail during spring summer season lead to heavy plant mortality and less fruiting in these regions. Due to one or the other problems, farmers are not getting the desired production potential of the crop. Thus another reason for lower productivity may be that farmers in India generally do not use any special technique like spacing for quality okra production. Among the cultural practices, the spacing allowed to individual plant is one of the most important factor which control their development and yield. Appropriate crop geometry can lead to optimum fruit and seed yield whereas too high or low plant spacing could result in relatively low yields.

MATERIALS AND METHODS

The field experiment entitled was carried out during *Kharif* season of 2018-19 and 2019-20 at Instructional Farm, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner. Bikaner is situated at 28° 01′N latitude and 73° 22′E longitude at an altitude of 234.70 meters above Mean Sea Level. As per NARP, Bikaner falls in Agro climatic zone IC (Hyper Arid Partially Irrigated North Western Plain Zone). Experiments were set up in a split plot design and repeated three times. In the main plot, four irrigation levels (40, 60, 80, and 100 per cent PE), in the sub-plot, two crop geometry (normal sowing at 50 cm row spacing and paired row sowing at 30 cm × 70 cm) and in the sub-sub plot, three mulch (no mulch, straw, and plastic mulch) were tested alone and its combination.

Drip irrigation was given to experimental fields on the basis of pan evaporation by the prevailing atmospheric conditions recorded daily from Agro-Meteorological observatory A.R.S., Beechwal, SKRAU, Bikaner. Considering equal plant population two geometries were taken for the experiment as per treatment**.** Straw mulch was applied as per treatment. Mustard straw @ 10 t ha^{-1} and plastic sheet (25 micron) was used as mulch, which was spread between rows at 20 DAS in each marked plot. Data were collected from five randomly selected plants for each plot and the recorded parameters were days to fruiting and fruit picking.

Table 1: Month wise irrigation events and irrigation water applied during *kharif,* 2018-19.

Month	Irrigation events	Irrigation water applied (mm) including rainfall			
		40% PE	60% PE	80% PE	100% PE
July (15-31)	03	21.6	32.4	43.2	54.0
August (1-31)	12	43.7	65.5	87.4	109.2
Sept. (1-30)	15	80.0	120.0	160.0	200.0
Oct. (1-28)	14	68.8	103.2	137.6	172.0
Total	44	214.1	321.1	428.2	535.2
Irrigation before sowing (mm)		50.0	50.0	50.0	50.0
Rainfall (mm)		236.2	236.2	236.2	236.2
Total		**500.3**	**607.3**	**714.4**	**821.4**

Table 2: Month wise irrigation events and irrigation water applied during *kharif,* 2019-20.

Month	Irrigation events	Irrigation water applied (mm) including rain fall			
		40% PE	60% PE	80% PE	100% PE
July (16-31)	05	36.2	54.2	72.3	90.4
August (1-31)	11	53.1	79.7	106.2	132.8
Sept. (1-30)	14	115.1	172.7	230.2	287.8
Oct. (1-30)	13	108.5	162.7	217.0	271.2
Total	43	312.9	469.3	625.8	782.2
Irrigation before sowing (mm)		50.0	50.0	50.0	50.0
Rainfall (mm)		213.8	213.8	213.8	213.8
Total		**576.7**	**733.1**	**889.6**	**1046.0**

RESULTS AND DISCUSSION

Days to first fruiting. The data in Table 3 showed that days to first fruiting was recorded minimum with 40 per cent PE levels of drip irrigation, whereas, maximum with 100 per cent PE drip irrigation level. This might be due to poor ability of okra crop to absorb nutrients during reproductive growth compared to vegetative phase which is responsible for reduced water uptake by the plant resulting in deterioration of the root system when assimilate is diverted towards the flowers and fruits. Similar results were also reported by Imtiyaz *et al.* (2000). During both years and the pooled analysis, the crop geometry had no significant effect on days to first fruiting. The number of days to first fruiting was considerably impacted by the treatment of different types of mulches throughout both years and in the pooled analysis, based on detailed investigation of the data. In straw mulch, the least time to first fruit initiation (49.72 days) was observed, which was at par with plastic mulch. In comparison to no mulch and plastic mulch, straw mulch took the shortest time to initiate fruiting. Choudhary *et al.* (2012) found similar results in okra as well.

Days to first fruit picking. Data on days to first fruit picking have been presented in Table 3. The results showed that days to first fruit picking significantly decreased with decreasing levels of irrigation during both years and in pooled analysis. Minimum days were taken to first fruit picking (52.68, 51.35 and 52.01 days) at 40 per cent PE level of drip which was statistically higher over 60 per cent PE and 80 per cent PE and 100 per cent PE level of drip irrigation. Similar findings were also reported by Kumari *et al.* (2018). Crop geometry had almost no effect on days to first fruit picking. Minimum days to first fruit picking (55.12 days) was observed in straw mulch which was at par with plastic

mulch whereas maximum days to first fruit picking were recorded in no mulch (59.48 days), respectively. It was observed that straw mulch took 7.91, and 5.59 per cent less days to first fruit picking than the plastic and no mulch, respectively.

Table 3: Effect of irrigation levels, crop geometry and mulches on days to first fruiting and picking of okra.

Treatments	Days to first fruiting			Days to first picking		
	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled
Irrigation levels						
40% PE	47.01	46.82	46.92	52.68	51.35	52.01
60% PE	51.50	50.93	51.21	56.85	56.21	56.53
80% PE	53.21	53.68	53.45	59.05	59.72	59.38
100% PE	53.77	54.22	53.99	59.66	60.31	59.99
S.Em.±	1.08	1.16	0.79	1.20	1.38	0.91
CD at 5 %	3.75	4.03	2.45	4.14	4.79	2.82
Crop geometry						
Normal sowing (50 cm)	50.64	51.11	50.87	56.25	56.56	56.40
Paired row sowing (30 cm × 70 cm)	52.11	51.72	51.91	57.87	57.24	57.55
S.Em.±	0.87	0.89	0.62	0.96	1.09	0.73
CD at 5 %	NS	NS	NS	NS	NS	NS
Mulch						
No mulch	53.79	53.52	53.65	59.73	59.22	59.48
Straw mulch	49.84	49.59	49.72	55.36	54.89	55.12
Plastic mulch	50.49	51.12	50.81	56.09	56.58	56.33
S.Em.±	0.87	0.82	0.60	0.96	0.93	0.67
CD at 5 %	2.50	2.36	1.69	2.76	2.69	1.89

CONCLUSIONS

Out of the four irrigation levels days to first fruiting and picking was recorded minimum with 40 per cent PE levels of drip irrigation, whereas, maximum time required at 100 per cent PE drip irrigation level. The crop geometry had no significant effect on days to first fruiting and picking. In straw mulch, the least time to first fruit initiation and fruit picking.

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Conflict of Interest. None.

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