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**Performance evaluation of drip irrigation on
strawberry (*Fragaria*) yield and water use
efficiency**

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Abstract

An experiment was conducted at the Hi-horticultural research farm of Dr. Rajendra Prasad Central Agricultural University, Pusa (Samastipur) Bihar, for two consecutive years for strawberry variety Festival using drip irrigation method and conventional system of irrigation. Three level of irrigation (IW/CPE=0.6, 0.8 and 1.0) with drip irrigation gave significant higher yield as compared to conventional furrow irrigation method for single row planting and paired row planting methods. Single row planting method gave higher yield as compared to paired row planting method with drip irrigation but increase in yield was statistically non significant. Drip irrigation with single row and paired row planting method saves 68.5% and 53.3% water, respectively as compared to conventional furrow irrigation method. Maximum irrigation water use efficiency (114.21 kg/ha-cm) was achieved at low level of irrigation. Drip with paired row planting reduce the number of lateral line to half, therefore, it is better to use paired row planting with drip from economic point of view.

Keywords: Drip irrigation, yield, furrow irrigation, level of irrigation, single row and paired row planting, water use efficiency

1. Introduction

Strawberry is one of the most delicious and refreshing fruits of the world, which was introduced in India during the early sixties, but could not be popularized due to several reasons. However, during the last decade, it has become favourite fruit among growers because of its remunerative prices and higher profitability. For successful strawberry cultivation, planting time plays very significant role. In India, strawberry is usually planted in second fortnight of October with traditional methods, which restrict the fruit availability for a very short period (one half month). Further, higher profitability and productivity of strawberry are being taken in many countries either with staggered planting or with the use of plasticulture technique. However, such agr-techniques have not yet been standardized under Indian conditions.

Micro-irrigation of strawberry plants is more extensively used in view of possibilities to efficiently control the processes in the irrigation system and in the plant irrigated. This method meets in full the requirements for sustainable agriculture and ecological fruit production, as well as it provides high yields, and reduces the unwanted side effects (Kireva, Petkov; Petrova, Moteva *et al.*) [4, 7, 5]. Applying this method of irrigation in strawberry cultivation which is of essential economic importance mainly because of its high productivity and production efficiency, requires to establish in detail the parameters of irrigation regime under the particular conditions in India.

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The studies for strawberry irrigation performed up to now show that this culture reacts very well to micro irrigation both with respect to the production volume and with respect to the quality. (Taparaskiene, Miseckaite) [8]. The research in India and abroad show that a reasonable regulation of soil moisture during blossoming and ripening may increase the yield from 20% to 50% (Ivanov) [3] and has a significant influence on total yield, berry weight, and leaf area. The results of strawberry research obtained in foreign countries, show the positive effect of irrigation (Taparaskiene, Miseckaite) [8] and saving of irrigation water may reach from 20 up to 40% (Cetin, *et al.*, Kireva, Petkov; Petkov, *et al.*, Petrova) [2, 4, 6]. The purpose of this research is to establish the main parameters of irrigation regime, the productivity of irrigation water for strawberries cultivated at drip irrigation on open areas.

2. Materials and Methods

A field study was conducted at the the Hi-horticultural research farm of Dr. Rajendra Prasad Central Agriculturalal University, Pusa (Samastipur) Bihar, for two consecutive years for strawberry variety *Festival* using drip irrigation method and conventional furrow irrigation method. A built in type of drip irrigation system was used to irrigate the crop. In the field experiment, two factors that drip irrigation and conventional furrow irrigation with two methods of sowing viz paired row planting and single row planting method was used. Three level of irrigation for drip were on the basis of IW/CPE ratios (irrigation water applied/cumulative pan evaporation) 0.6, 0.8 and 1.0 used to irrigate the crop. To meet the water requirement of the crop, 10mm depth of water was applied during irrigation and interval between two irrigations depends upon the IW/CPE ratio for different treatment of drip irrigation. Irrigation to conventional furrow plots was provided as per recommended package and practices. The experiment was laid out in split plot design with total 24 plots and each treatment replicated thrice. The size of the each plot was 5.1 m X 2.4 m. Recommended dose of fertilizer [1] was applied as per the package and practices.

The crop geometry of the crop was altered (from single row to paired row) to reduce the number of lateral line. To alter the crop geometry only row-to-row spacing was changed, keeping plant to plant spacing same (30 cm) such that number of plants per unit area remains the same.

3. Results and Discussion

3.1 Effect of different Irrigation levels

Comparison of different irrigation level (Table 1) indicates significant difference in yield strawberry crop by drip irrigation method with single row planting and paired row planting as compared to conventional furrow irrigation method. However, within drip irrigation method with single and paired row planting, there was statistically non-significant difference in yield at different level of irrigation. Also, Table 1 indicates that average fruit size differ non-significant for different level of irrigation with drip irrigation and furrow irrigation method.

3.2 Water Saving

Table 2 shows that there was non-significant difference in yield for different levels of irrigation with drip (for single and paired row planting). Though Table 2 indicates less yield of strawberry at low level of irrigation (IW/CPE ratio 0.6) as compared to high level of irrigation (IW/CPE ratio 1.0) but statistically this difference is non-significant. However, if one compares low level of irrigation with high level of drip irrigation, the amount of water saving is 40%. This trend is similar in both types of planting method (single and paired row planting). Statistically there was none significant difference in yield at different level of irrigation with drip, but differ significantly when drip yield was compared to conventional furrow irrigation. Drip at low level of irrigation (IW/CPE=0.6) saves 53.3% water as compared to furrow irrigation with paired row planting method, whereas in case of single row planting at low level of drip irrigation (IW/CPE=0.6) water saving is 68.5% as compared to furrow irrigation. The paired row planting method with drip shows less quantity of irrigation water saved because conventional paired row planting method consume 32.5% less water as compared to conventional single row planting method.

3.3 Irrigation water use efficiency

Table 2 represents the irrigation water use efficiency (IWUE) for different level of irrigation for paired row and single row planting. Maximum (114.21 kg/ha-cm) IWUE was achieved for single row planting with drip irrigation at low level (IW/CPE=0.6), which is 272% higher as compared to conventional furrow irrigation method with same method of planting and in case of paired row planting with drip irrigation IWUE was (101.59 kg/ha-cm) at low level of irrigation. Single row planting gave 12.4% higher IWUE as compared to paired row planting at low level of irrigation.

Table 1: Average fruit height and yield of strawberry crop influenced by different levels of irrigation

Method of irrigation	When to irrigate	Average fruit size (cm)		Yield (qtls/ha)	
		IW/CPE ratio	Single line	Paired line	Single line
Drip	0.6	3.10	2.70	28.78	25.59
	0.8	3.20	3.90	28.83	25.73
	1.0	3.95	2.40	29.90	26.25
Furrow irrigation	Weekly	4.10	3.45	24.56	23.82

Table 2: Amount of water applied to different treatments and its effect on Strawberry yield and irrigation water use efficiency (IWUE)

Method of irrigation	When to irrigate	Yield (qtls/ha)		Irrigation water applied (cm)		IWUE (kg/ha-cm)	
		Single Line	Paired Line	Single Line	Paired Line	Single Line	Paired Line
Drip	0.6	28.78	25.59	25.2	25.2	114.21	101.55
	0.8	28.83	25.73	33.6	33.6	85.50	76.58
	1.0	29.90	26.25	42.0	42.0	71.20	62.50
Furrow irrigation	Weekly	24.56	23.82	80.0	54.0	30.70	44.11

4. Conclusion

It can be concluded from the present study that drip irrigation method with single and paired row planting gave significantly higher yield as compared to conventional furrow irrigation method. Paired row planting with drip irrigation gave better yield, saving of irrigation water and higher irrigation water use efficiency as compared to conventional furrow irrigation method. Paired row planting method with furrow irrigation saves 32.5% water as compared to conventional single row planting method with furrow irrigation. From economic point of view paired row planting was better as compared to single row planting for drip irrigation, because it reduce the number of lateral lines to half.

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