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RESEARCH PAPER

Yield response and economic evaluation of drip-fertigated muskmelon cultivated under mulched conditions

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Abstract

A study was carried out to standardize the moisture regime (irrigation) and fertigation (N:P:K levels) for improved crop establishment, plant growth, yield and fruit quality of muskmelon under drip irrigation cum fertigation and mulching during 2017-18 and 2018-19. The treatments included three levels of drip irrigation viz. 100% of crop evapotranspiration (ET_c), 80% of ET_c and 60% of ET_c, with and without silver black polythene plastic mulching in main plots and three levels of fertigation viz. 100% of recommended dose of fertilizer (RDF), 80% of RDF and 60% of RDF in subplots. Drip irrigation at 100% of ET_c and fertigation at 100% of RDF with mulching helped to improve the vine length, number of primary branches, average fruit weight, diameter and yield when compared with conventional (control) as well as other treatments. These results were statistically at par with that obtained under drip irrigation at 80% of ET_c and fertigation at 80% of RDF with mulching. The yield under drip fertigation varied from 168.8-202.8 q/ha, which is about 16.5% higher as compared to conventional treatment. Drip fertigation under mulched conditions resulted in 17.2% higher net returns as compared to conventional treatment. Thus, it may be concluded that drip fertigation at 80% of ET_c and fertigation at 80% of RDF with plastic mulching is beneficial for improving productivity of muskmelon with about 80.9% and 20.0% saving of water and fertilizers as compared to conventional method in the present study region.

Keywords: Drip irrigation, Fertigation, Mulching, Muskmelon, Crop evapotranspiration.

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Introduction

Muskmelon (*Cucumis melo L.*) is one of the important commercial cucurbits, cultivated in both tropical and sub-tropical regions of the world. It belongs to genus *Cucumis* and *Cucurbitaceae* family with a chromosome number of 2n = 24. Application of the optimum amount of irrigation in melons is crucial to maximize the yield and save water (Mirabad *et al*., 2014; Anusha, *et al*., 2021). Excessive irrigation results in yield reduction, poor fruit quality (reduced TSS) and increased sensitivity of plant to fungal diseases (Sensoy *et al*., 2007), whereas deficit irrigation results in a smaller number of fruits and lower yields (Kirnak *et al*., 2005). Besides, there is a well-established relationship between muskmelon quality and soil moisture regime. Therefore, to avoid water stress and excessive moisture conditions, irrigation scheduling can play an important role. Conventional irrigation methods are most widely practiced all over the world but result in very low WUE (WUE) as a major proportion of irrigation water is lost by runoff, deep percolation and surface evaporation. Modern techniques include optimization of water and fertilizer usage, resulting in upgraded crop production and limiting the danger of water losses and nutrient leaching. Thus, drip fertigation system is the most efficacious way to supply water and nutrients to the plant along with improved WUE, NUE and yield (Tiwari *et al*., 1998).

Drip fertigation allows the application of water and nutrients directly into the root zone of the plants. This technique saves water and fertilizers by about 50 to 60%, with yield increase of 15 to 20% (Kumar 2013). Enhanced responses of vegetable crops to fertigation have been observed in tomatoes, lettuce, potato and pepper (Clough *et al*., 1990; Bar-Yosef & Sagiv, 1982; Qawasmi *et al*., 1999). In melons, improved growth, increased fruit weight and size along with earliness have been observed under drip irrigation system (Leskovar *et al*., 2001). Antunez *et al*. (2011) also reported that drip-irrigated melon plants tend to produce higher yield (up to 35%), higher soluble solid content and titrable acidity in fruits. Further, to enhance WUE combination of drip irrigation and mulching can prove to be beneficial. Mulch application reduces the leaching of nutrients, lower soil evaporation, controls of unwanted plants, and conserves soil moisture. Ekinci & Dursun (2009) have reported early fruiting and higher yield in drip-fertigated muskmelon under mulched conditions. Available knowledge about the effect of drip fertigation and mulch application on growth characteristics, melon yield, and WUE is limited in the northern part of India. Thus, keeping this in view, the present study was undertaken to evaluate the yield response and economic feasibility of drip-fertigated muskmelon under mulched conditions.

Materials and Methods

The experimental trials were carried out during the summer season in 2017-18 and 2018-19 at the Research Farm of the Department of Vegetable Science, Punjab Agricultural University, Ludhiana. Soil of the experimental site was subjected to physio-chemical analysis before crop plantation. The hybrid MH-27 was cultivated. The treatments included three levels of drip irrigation viz. 100% of ET_c (I_1), 80% of ET_c (I_2) and 60% of ET_c (I_3) with (M_1) and without (M_0) silver black polythene mulch in main plots and three level of fertigation viz.100% of RDF (F_1), 80% of RDF (F_2) and 60% of RDF (F_3) in sub plots. A total 18 treatments were replicated thrice in split plot design. Silver-black plastic mulch was laid on the field prior to the transplanting of the crop. Irrigations were given on a gap of one day by calculating the ET_o. The ET_o was estimated by the Penman–Monteith equation using daily meteorological data obtained from the meteorological observatory of PAU Ludhiana. The initial, mid and end-season crop coefficient values for muskmelon are 0.5, 0.85 and 0.65 respectively (Allen *et al*., 1998). Having known ET_o and K_c values, ET_c was calculated using the equation reported by Doorenbos & Pruitt (1974).

$$ETo = \frac{0.408\Delta(Rn\text{-}G)+G4\frac{900}{T+273}U2)(es\text{-}ea)}{\Delta+e73\Delta tiona2)}$$

Where ET_o = reference evapotranspiration (mm/day), R_n = net radiation at the crop surface (MJ/m^2/day), G = soil heat flux (MJ/m^2/day), T = daily mean temperature at 2.0 m height (°C), U_2 = wind speed at 2 m height (m/s), e_s= saturation vapor pressure (kPa), e_a= actual vapor pressure (kPa), e_s-e_a= vapor pressure deficit (kPa/°C), Δ= slope of vapor pressure curve (kPa/°C) and ϒ= psychrometric constant (kPa/°C).

$ET_c = ET_o$* Crop coefficient (K_c)

Fertigation was given at a frequency of 4 days with the help of venturi connected with a drip-irrigation system. The fertilizer application was in 14 splits. Each split included 259.3 g of Urea (46% N), 170.45 g of Urea phosphate (18% N and 44% P) and 156.25 g of sulphate of potash (48% K) as source of N, P and K, respectively. The quantity of fertilizer applied per plot per split is presented in Table 1.

Nursery of hybrid MH-27 was sown 30 days in plug trays before transplanting. The ready seedlings were transplanted in mid-February on both sides of 3 m wide beds at 60 cm between the two rows. Two drip laterals per bed having drippers spaced at 40 cm and discharge of 2.2 litres per hour were laid. Rest of the agronomic practices was followed in accordance with the package of practice. The crop data recorded during crop period included vine length, number of primary branches per plant, number of fruits per vine, average fruit weight, fruit diameter, and yield. The recorded crop data was analysed using SPSS software at 5% level of significance. Economic analysis was also carried out to compare the net returns generated in drip fertigated plot as compared to Control of conventional treatment.

Results and Discussion

Irrigation Water Saving

The quantity of water applied under different irrigation levels is given in Table 2. Maximum depth of water was applied under conventional method of irrigation (71.32 cm). A significant amount of water was saved using drip irrigation. The data analysis depicted highest water saving in treatment I_3 (80.85%), followed by I_2 (74.43%) and lowest in I_1(68%). Alenazi *et al*. (2015) observed a similar trend of water saving with the increasing depth of irrigation in two different varieties of muskmelon.

Growth Attributes

Agronomically, vine length and number of primary branches are important traits that affect the yield potential of the crop. The length of the main vine (at 30 and 60 DAT) and number

Table 1: Quantity of fertilizer applied (g) per plot per split for the whole season

Treatments	*Quantity of fertilizer required in each split*		
	Urea (46% N) (g)	*Urea phosphate (18% N, 44% P) (g)*	*Sulphate of potash (48% K) (g)*
F_1 (100% RDF)	18.52	12.17	11.16
F_2 (80% RDF)	14.81	9.74	8.93
F_3 (60% RDF)	11.11	7.30	6.69

Table 2: Comparison of water applied in different treatments

Irrigation treatments	*Total depth of irrigation water applied (cm)*	*Conventional irrigation (cm)*	*Percentage of saving water over conventional irrigation*
Water saving during 2017-18			
I_1 (100% ET_c)	24.29	71.58	66.06
I_2 (80% ET_c)	19.43	71.58	72.85
I_3 (60% ET_c)	14.57	71.58	79.64
Water saving during 2018-19			
I_1 (100% ET_c)	21.35	71.06	69.95
I_2 (80% ET_c)	17.05	71.06	76.00
I_3 (60% ET_c)	12.76	71.06	82.04
Mean data			
I_1 (100% ET_c)	22.82	71.32	68.00
I_2 (80% ET_c)	18.24	71.32	74.43
I_3 (60% ET_c)	13.66	71.32	80.85

of primary branches number as affected with different treatments are presented in Table 3. Treatment 100% of ET_c I_1 resulted in significantly higher vine length (at 30 and 60 DAT) and number of primary branches over the treatment where drip irrigation was applied at 60% of ET_c (I_3). The results of irrigation at 100% crop ET_c (I_1) and 80% of ET_c (I_2) were statistically similar. Maximum vine length was recorded under I_1 followed by I_2. Significantly lower vine length was recorded under I_3. Application of mulch (M_1) resulted in a significantly increased number of primary branches and vine length during both seasons. Among different fertigation levels, 100% of RDF (F_1) resulted in the highest vine length and number of primary branches, which were at par with 80% of RDF (F_2), and significantly higher as compared to 60% of RDF (F_3). However, during second season, no significant difference was recorded among F_1, F_2 and F_3 at 60 DAT. None of the interactions were found to be significant, stating the independent behavior of each factor.

Flexas *et al*. (2004) reported a decrease in plant growth with a decrease in irrigation depth in relation to the adverse effect on photosynthetic activity due to stomatal closure and reduced availability of CO_2 for chloroplast. Improvement in

Table 3: Length of main vine and number of primary branches

Treatments	*Length of main vine (cm) (30 DAT)*			*Length of main vine (cm) (60 DAT)*			*Number of primary branches*		
	2017-18	*2018-19*	*Mean*	*2017-18*	*2018-19*	*Mean*	*2017-18*	*2018-19*	*Mean*
Control	90.90	92.70	91.80	185.60	187.70	186.70	2.60	2.90	2.80
Irrigation (I)									
I_1 (100% ET_c)	98.00	99.50	98.70	196.90	201.60	199.20	2.90	3.20	3.10
I_2 (80% ET_c)	93.50	95.90	94.70	188.70	194.50	191.60	2.80	2.90	2.80
I_3 (60% ET_c)	82.70	85.30	84.00	176.90	184.90	180.90	2.50	2.60	2.50
CD (p= 0.05)	6.30	6.20	6.20	7.70	10.00	8.30	0.20	0.20	0.20
Mulch (M)									
M_1 (Mulch)	95.40	97.80	96.60	192.30	198.40	195.30	2.90	3.10	3.00
M_0 (No mulch)	87.40	89.40	88.40	182.70	188.90	185.80	2.60	2.80	2.70
CD (p= 0.05)	5.10	5.00	5.10	6.30	8.20	6.80	0.10	0.20	0.10
Fertigation (F)									
F_1 (100% RDF)	94.90	96.90	95.90	191.90	197.70	194.80	2.90	3.20	3.10
F_2 (80% RDF)	92.70	95.20	93.90	188.40	194.50	191.40	2.70	3.00	2.90
F_3 (60% RDF)	86.70	88.60	87.60	181.00	188.70	185.50	2.40	2.60	2.60
CD (p= 0.05)	3.40	3.50	3.50	7.00	NS	NS	0.20	0.20	0.20
Interaction									
I × M	NS	NS	NS	NS	NS	NS	NS	NS	NS
I × F	NS	NS	NS	NS	NS	NS	NS	NS	NS
M × F	NS	NS	NS	NS	NS	NS	NS	NS	NS
I ×M ×F	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 4: Fruit number, Average fruit weight, Fruit diameter and Total yield

Treatments	Fruit number			Fruit diameter (cm)			Average fruit weight (g)			Total yield (q/ha)			Water use efficiency (q/ha-cm)		
	2017-18	2018-19	Mean	2017-18	2018-19	Mean	2017-18	2018-19	Mean	2017-18	2018-19	Mean	2017-18	2018-19	Mean
Control	3.45	3.50	3.48	15.90	16.80	16.30	878	880	879	170.90	167.80	169.30	2.39	2.36	2.37
Irrigation (I)															
I_1 (100% ET_c)	3.94	3.94	3.94	17.30	19.00	18.10	902	902	902	197.50	201.80	199.60	8.21	9.35	8.78
I_2 (80% ET_c)	3.80	3.84	3.82	16.90	18.80	17.80	884	882	883	191.10	192.60	191.80	9.84	11.30	10.57
I_3 (60% ET_c)	3.68	3.71	3.70	15.90	17.70	16.80	803	807	805	168.80	171.30	170.00	11.59	13.42	12.51
CD (p= 0.05)	NS	NS	NS	0.30	0.30	0.30	51	52	49	14.10	15.70	13.20	0.69	0.98	0.72
Mulch															
M_1 (Mulch)	3.87	3.89	3.88	17.10	19.00	18.00	915	918	917	198.50	202.80	200.60	10.60	12.23	11.42
M_0 (No mulch)	3.74	3.77	3.76	16.20	18.00	17.10	810	809	810	171.40	176.00	173.70	9.15	10.49	9.82
CD (p= 0.05)	NS	NS	NS	0.30	0.30	0.30	42	42	40	11.50	12.80	10.80	0.57	0.80	0.59
Fertigation															
F_1 (100% RDF)	3.90	3.91	3.91	17.20	18.90	18.10	891	889	890	193.50	197.90	196.70	10.36	11.85	11.11
F_2 (80% RDF)	3.79	3.84	3.82	16.90	18.80	17.80	871	873	872	187.90	191.10	189.50	9.94	11.54	10.74
F_3 (60% RDF)	3.73	3.73	3.73	15.90	17.90	16.90	826	829	828	173.50	178.70	176.10	9.34	10.69	10.02
CD (p= 0.05)	NS	NS	NS	0.40	0.30	0.30	32	46	35	8.80	12.20	9.40	0.44	0.78	0.54
Interaction															
I × M	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
I × F	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
M × F	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
I ×M ×F	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

ET_c: Evapotranspiration of the crop RDF: Recommended dose of fertilizers Control: Conventional method
NS: Non-significant

Table 5: Comparative economic analysis of drip irrigation system (with and without mulch) and conventional method for one hectare

S. No.	*Description*	*Drip with mulch*	*Drip without mulch*	*Conventional*
1.	Main, sub main, pump, fertilizer tank etc			
	A) Fixed cost (Rs)	61898	61898	
	B) Accessories (10% of a)	6189.8	6189.8	
	C) Total cost (a+b)	68087.8	68087.8	
	D) Life in years	20	20	
	E) Depreciation on capital by taking two crops per year (c/40)	1702	1702.19	
	F) Interest @8% per crop by taking two crops per year (c*0.08/4)	1362	1361.75	
	G) Total (e+f)	3064	3063.95	
2.	Lateral and installation			
	A) Cost of laterals with inbuild emitters @10.45 per metre for 1 ha	22000	22000	
	B) Cost of installation	2200	2200	
	C) Total cost	24200	24200	
	D) Life in year	10	10	
	E) Depreciation on capital by taking two crops per year	1210	1210	
	F) Interest @8% per crop by taking two crops per year (d*0.08/4)	484	484	
	G) Total cost (e+f)	1694	1694	
3.	Mulch	17500		
4.	Cultivation cost of muskmelon (RS)	55289	55289	61789
5.	Total cost of cultivation (Rs)	77547	60047	61789
6.	Produce (q/ha)	207.57	184.41	169.37
7.	Selling price (Rs/q)	1000	1000	1000
8.	Gross income (Rs)	207570	184410	169370
9.	Net income (Rs)	130023	124362	107580

plant growth under silver or black plastic mulch was also reported by Parmar *et al*. (2013) in watermelon, which may be due to congenial microclimatic and soil moisture conditions under mulching. Feleafel *et al*. (2014) reported an increase in growth characteristics of cucumber with an increase in N:P:K fertigation rates. Higher fertilizer dose resulting in enhancement of chlorophyll and carbohydrate synthesis, might have resulted in higher vegetative growth.

Yield attributes

Data on number of fruits, fruit weight, and fruit diameter are presented in Table 4. Statistical analysis of the data depicted no significant differences in number of fruits under different levels of irrigation, fertigation and mulching during both seasons, whereas fruit weight and diameter showed significant differences. Irrigation treatment I_1 resulted in the highest fruit weight and diameter, followed by I_2, and I_3. Irrigation levels I_1 and I_2 were found to be statistically at par with each other. Mulch application (M_1) significantly improved the fruit weight and diameter. The increase in fruit weight under silver-black polythene mulch over the bare soil was 13.2%. An increase in the average fruit weight of muskmelon cultivated under mulched conditions was also observed by Maiero *et al*. (1987). The improved microclimate around crop resulting in better crop establishment leading to higher photosynthetic activity and net assimilated production might be the reason for a significant increase in average fruit weight. The weight and diameter of the fruit also recorded a significant increase with the increase in the dose of fertilizers. Among the fertigation levels, F_1 registered the maximum values followed by F_2. Notably lower value of fruit weight and diameter were result in F_3. Fertigation levels F_1 and F_2 were statistically at par with each other. The increase in fruit weight under treatment F_1 and F_2 might be attributed to an increased dose of fertilizer, resulting in increased uptake of nutrients, dry matter production and yield. More dry matter production and nutrient uptake leads to increased synthesis of assimilates which might have translocated efficiently to the fruit, thereby, increasing the average fruit weight.

Yield

Total yield under different treatments is presented in Table 4. Statistical analysis depicted significantly different yields under different levels of irrigation and fertigation. Silver-black polythene mulch also significantly improved crop growth, thereby enhancing the yield. Maximum crop yield was observed in I_1 (100% of ET_c), which was at par with I_2 (80% of ET_c). The lowest yield was recorded under I_3 (60% of ET_c). The yield under I_1 and I_2 were statistically at par with each other. Bare soil (M_0) resulted in significantly lower yield when compared with mulch conditions. Yield observed under silver-black polythene mulch (M_1) was 15.53% higher over the non-mulch (M_0) treatment. Fertigation also significantly affected the yield, recorded highest under F_1 (100% of RDF) followed by F_2 (80% of RDF), being significantly higher over F_3 (60% of RDF). Fertigation levels F_1 and F_2 were statistically at par with each other. Yield from different treatments of drip fertigation and mulch varied from 168.8 to 202.8 q/ha, being about 16.5% higher in comparison to that recorded from bare soil (conventional system). The conventional method involves many losses such as runoff, evaporation, deep percolation, volatilization and leaching of nutrients which might have contributed to lesser availability of nutrients and moisture to the plants for growth and development and to meet the potential evapotranspiration requirements of the crop, thereby resulting in lower yield.

Yildiram *et al.* (2009) reported a significant decrease in yield of muskmelon under water stress. Earlier findings of Ibbara *et al.* (2001) in muskmelon revealed increased crop yield under mulch application. Eifediyi & Remison (2009) in cucumber reported increase in crop yield with an increase in fertilizer dose through drip irrigation system. Higher nutrient and water use efficiencies might be the reason for increased yield when fertilizers were applied along with irrigation water (Manfrinato, 1971).

Water use Efficiency

Different levels of irrigation, fertigation and mulch significantly influenced the water use efficiency (WUE) (Table 4). Results uncovered that WUE in I_1 (100% of ET_c) treatment was significantly lower when compared with I_2 (805 of ET_c) and I_3 (60% of ET_c). The result showed that an increase in the levels of irrigation leads to a corresponding decrease in WUE. Increase in WUE was 29.81% in I_3 over I_1. The lowest WUE was observed in I_1, however, the maximum yield was obtained from this treatment. The application of mulch further increased the WUE. WUE was recorded to be 14.0% higher under silver-black polythene mulch (M_1) when compared with no mulch (M_0) condition. Reduced evaporation from soil surface under mulch resulting in decreased evapotranspiration of the crop might be the reason for increased WUE. An increase in WUE with an increase in dose of fertilizers was also observed. F_1 recorded maximum WUE, followed by F_2 and F_3. WUE under F_1 and F_2 were found to be statistically at par with each other. An increase in WUE (about 2–3 times) with trickle irrigation system was reported by Leskover *et al.* (2001) in muskmelon in comparison with control. The above results indicate that increasing the depth of irrigation through drip system in muskmelon increased the total yield, but WUE was found to decrease.

Economic Analysis

Economic evaluation of a technology before its adoption is of utmost importance. To assess the economic viability of drip irrigation cum fertigation system in comparison with the conventional method, fixed cost, operating cost and interest were taken into consideration. Net returns for drip irrigation (with and without mulch) and conventional methods of irrigation were calculated. Net returns were found to be highest in drip irrigation along with mulch usage (130023 INR/ha), followed by drip irrigation systems without mulch application (124362 INR /ha). The conventional method of cultivation resulted in the lowest returns (Rs 107580/ ha) (Table 5). Saini and Singh (2006) reported 3.6 times higher net returns under drip irrigation when compared with conventional irrigation in different vegetable crop sequences (Cauliflower- Hybrid chilli).

Conclusion

The results of our study showed **s**ignificant improvements in growth and yield attributing characters under drip irrigation at 100% of ET_c and fertigation at 100% of RDF with plastic mulching (or 80% of ET_c and fertigation at 80% of RDF with plastic mulching) when compared with other treatments and Control. The yield and net returns under drip irrigation coupled fertigation were about 16.5% and 17.2% higher as compared to conventional practice. Thus, it may be concluded that drip irrigation at 80% of ET_c and fertigation at 80% of RDF with plastic mulching would be beneficial for improving productivity of muskmelon with about 80.9% and 20.0% saving of water and fertilizers in the present study region.

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सारांश

2017-18 और 2018-19 के दौरान ड्रिप सिंचाई सह फर्टिगेशन और मल्चिंग के तहत खरबूजे की बेहतर फसल स्थापना, पौधों की वृद्धि, उपज और फल की गुणवत्ता के लिए नमी व्यवस्था (सिंचाई) और फर्टिगेशन (एन:पी:के स्तर) को मानकीकृत करने के लिए एक अध्ययन किया गया था। उपचार में ड्रिप सिंचाई के तीन स्तर शामिल थे। 100% फसल वाष्पीकरण (ईटीसी), 80% ईटीसी और 60% ईटीसी, मुख्य भूखंडों में सिल्वर ब्लैक पॉलिथीन प्लास्टिक मल्चिंग के साथ और बिना और फर्टिगेशन के तीन स्तर। उर्वरक की अनुशंसित खुराक (आरडीएफ) का 100%, आरडीएफ का 80% और उप भूखंडों में आरडीएफ का 60%। ईटीसी के 100% पर ड्रिप सिंचाई और मल्चिंग के साथ आरडीएफ के 100% पर फर्टिगेशन से पारंपरिक (नियंत्रण) के साथ-साथ अन्य उपचारों की तुलना में बेल की लंबाई, प्राथमिक शाखाओं की संख्या, औसत फल का वजन, व्यास और उपज में सुधार करने में मदद मिली। ये परिणाम सांख्यिकीय रूप से 80% ईटीसी पर ड्रिप सिंचाई और मल्चिंग के साथ 80% आरडीएफ पर फर्टिगेशन के तहत प्राप्त परिणामों के बराबर थे। ड्रिप फर्टिगेशन के तहत उपज 168.8 से 202.8 क्विंटल/हेक्टेयर तक रही, जो पारंपरिक उपचार की तुलना में लगभग 16.5% अधिक है। गीली अवस्था में ड्रिप फर्टिगेशन के परिणामस्वरूप पारंपरिक उपचार की तुलना में 17.2% अधिक शुद्ध रिटर्न प्राप्त हुआ। इस प्रकार वर्तमान अध्ययन क्षेत्र से यह निष्कर्ष निकाला जा सकता है कि 80% ईटीसी पर ड्रिप फर्टिगेशन और प्लास्टिक मल्चिंग के साथ 80% आरडीएफ पर फर्टिगेशन खरबूजे की उत्पादकता में सुधार के लिए फायदेमंद है, जिसमें पारंपरिक विधि की तुलना में लगभग 80.9% और 20.0% पानी और उर्वरक की बचत होती है।