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Growth and yield response of water melon (*Citrullus lanatus* var. lanatus) under drip fertigation

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■ **ABSTRACT :** A field experiment was conducted during 2016-17 at the experimental farm of PFDC, Kharagpur, India to investigate the effect of different levels of fertigation on the water melon growth and yield. The F1 hybrid water melon was planted in a 0.5 x 0.5 m spacing and drip irrigated with a row of drippers. Treatment consisted of of 5 levels (120,100,80,60,40%) with the Statistical Design Randomized Block with 4 replications. The growth and yield were increased with levels of fertigation at a maximum 32.75 and 29.25 t/ha with 100 and 80% of fertigation, respectively compared to 40% of fertigation.

■ **KEY WORDS :** Water melon, Drip irrigation, Water soluble fertilizers, Drip fertigation

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Watermelon (*Citrullus lanatus* Thunb.) has been cultivated initially in the Mississippi Valley and widespread generally in arid and semi-arid regions of the world. It is a vegetable with high water content giving the feeling of freshness and containing significant amounts of sugar, A, B and C vitamins (Kutevin and Ve Turkes, 1987 and Gunay, 1993). It is one of the important cucurbits vegetable crops grown extensively in India and in tropical and sub tropical countries of the world. It is a major river-bed crop of Uttar Pradesh, Rajasthan, Gujarat, Maharashtra, West Bengal and Andhra Pradesh. It is a popular dessert vegetable with year round availability. Cucurbits share about 5.6 per cent of the total vegetables production of India. China is the largest producer, with 65 million tons, equivalent to 66.3% of world total (FAO, 2011). Fertilization significantly affects the yield and quality of watermelon. Irrigation system and especially the fertigation technique increase the yield of watermelon (Colakoglu, 1990). Fertigation is defined as the application of nutrients by drip irrigation system. The nutrients can be supplied incrementally throughout the season to meet the actual nutritional requirements of the crop. In the other irrigation systems, fertilizers can easily leach with the excess irrigation water and plants cannot benefit from the fertilizers. As a result, economic losses can take place in addition, in the fertigation system are used less than the other systems. The aim of the paper was to compare fruit yields of different levels of fertigation grown under drip irrigation with fertigation in the vicinity of West Bengal.

■ METHODOLOGY

Site and soil properties of experimental field plot :

The experiment was conducted at the experimental farm of Agricultural and Food Engineering Department, IIT, Kharagpur, India (22°19| N, 87°19| E, 48 m) during

the months of February–May (2016-2017). The site consisted of a red lateritic soil with a sandy loam texture (18.4% clay, 22.6% silt, and 59.0% sand), a maximum water holding capacity of 14.9%, bulk density 1.44 g cm^{-3} and a steady state infiltration rate of 10 mm h^{-1}.

Experimental treatments and field preparation :

A field plot of size 27m×08 m was selected for experimental purpose. The 25m long strip represents a single replication which is further divided into five sub strips. Each sub strip represents as an individual treatment. There is a 30cm buffer between each sub strip to make difference from each treatment. Laterals were laid in the centre of the strip with 4 l h^{-1} emitters. Irrigation was applied at 3-4 days interval and the experiment was laid out in a Randomized Complete Block Design (RCBD) with 5 treatments and 4 replications. The treatments were allocated randomly to each block.

The various treatments were as follows:

T_1 : 120% of fertigation through drip line

T_2 : 100% of fertigation through drip line

T_3 : 80% of fertigation through drip line

T_4 : 60% of fertigation through drip line

T_5 : 40% of fertigation through drip line

Seed sowing and irrigation system installation

Seeds were sown in a raised bed and a crop spacing of 50cm×50 cm was used. The drip irrigation system was operated at regular intervals from the date sowing. The lateral lines were laid in between the two rows of crop and 4 Lh^{-1} emitters were installed 1.0 m apart (one emitter for four plants).

Field management :

The fertilizer doses of 200 kg N, 100 kg P and 100 kg K along with 30 t of farmyard manure (FYM) per ha were applied to meet the nutritional requirements of crop. The RDF (recommended dose of fertilizer) were applied in the form of water soluble fertilizers (WSF) like 19:19:19 (53 kg/ha), 13:0:45 (199 kg/ha), 12:61:0 (25 kg/ha), urea (351 kg/ha) were used in the fertigation system in the form of a split doses at 7- 10 days intervals.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Effect on plant growth parameters :

Plant grown under drip fertigation showed significant response to various levels of fertigation mainly vine length, vine diameter, leaf number, branch number, number of fruit/plant, number of fruit/ ha, and total yield but individual fruit weight not responded significantly to fertigation levels.

Main vine length grew to a maximum length of cm under treatment T_1 (120%) and minimum vine length was recorded under treatment T_5, which is 40% level of fertigation. Vine length showed significant response to fertigation levels of different treatments may be due to applying fertilizers in solute form near the crop root zone which promotes the swift up take of nutrients and rapid development of other parts in plants. Excess application of nutrients also influenced more growth and development of plants. This finding is in conformity with the results obtained by Jan *et al.* (2000) in bottle gourd and Hilli *et al.* (2009) in ridge gourd. Similarly in case of vine diameter maximum diameter was measured in treatment T_{120} and minimum was measured under treatment T_{40} and rest of the treatments significantly differed from each other. The increasing diameter of the vine may be due to different amount of nutrient levels which promotes cell division and cell enlargement of plants and also promotes photosynthesis. These results are similar to that of Hilli *et al.* (2009) in ridge gourd. Leaf number and no of branches/ plant were also shown the significant effect on fertigation levels. The maximum results were obtained under T_1 and lowest is under T_5 in both the cases. Similar results were observed by Jan *et al.* (2000) in bottle gourd (Table 1).

Effect on yield :

The data indicated that the effect of various treatments of fertigation levels on yield parameters *viz.*, number of fruits per plant, fruit length, fruit girth, and yield was found significantly in fruit of water melon. Individual fruit weight not responded well to different fertigation levels. It was found that all treatments of fertigation levels significantly increased the number of fruits per plant, the maximum was recorded under treatment T_2 followed by T_3 and least was recorded in the treatment T_5. Increasing number of fruit/plant may be due to sufficient level of nutrients available to plants and with decreasing the nutrient dose to some extent also showed significant effect on the number of fruits/

Table 1 : Effect of fertigation levels on plant growth parameters

Treatments	Main vine length (cm)	Vine diameter (mm)	Leaf number	No. of branches
T_1	116.075	6.45	20.85	6.875
T_2	108.15	6.325	20.475	6.7
T_3	100.75	6.2	20.475	6.45
T_4	91.6	5.9	18.725	5.9
T_5	69.65	5.725	15	5.5
S.E.±	6.10	0.12	0.39	0.22
C.D. (P=0.05)	18.94	0.27	1.20	0.69

Table 2 : Effect of fertigation levels on yield parameters

Treatments	Individual fruit wt.	No. of fruit/plant	Fruit length	Fruit girth	Yield (t/ha)
T_1	10.38	2.75	28	18.00	27.00
T_2	9.50	3.5	32.25	22.50	32.75
T_3	8.45	3	29	21.50	29.25
T_4	6.58	2	26.75	17.75	24.75
T_5	5.90	1.75	18.75	15.50	21.75
S.E.±	1.34	0.29	1.55	1.45	1.60
C.D. (P=0.05)	NS	1.09	4.78	4.48	4.93

NS=Non-significant

plant. The above results are in agreement with those of Rahul *et al*. (2010) in cucumber and Jan *et al.* (2000) in bottle gourd. It was found that application of fertilizers through fertigation in the form of water soluble fertilizers has shown the significant effect on the fruit length and fruit girth of the melon. It clearly shows that the maximum length was recorded under treatment T_2 and minimum was in treatment T_5, similarly in case of fruit girth highest was in T_2 followed by T_3 and least was in treatment T_5. The application of fertilizers in the liquid form is readily absorbed and utilized by plants. Excess application of fertilizers shows poor growth than the recommended dose which leads to loss of nutrients from the crop root zone in the form leaching and volatilization, similar findings were reported by Ravi Kumar *et al.* (2012) in cucumber. It was observed from Table 2 that greater yield was obtained with treatment T_2 followed by treatment T_3. The lowest yield was obtained in treatment T_5. The increasing yield with the increasing fertigation levels showed significantly upto treatment T_2 but decreasing the yield was shown in case of treatment T_1 which recorded lower than the treatment T_3. This may be due to excess application of fertilizers leads to loss of nutrients in the form of volatilization and leaching. The above results are in agreement with those of Jilani *et al.* (2009); Rahul *et al.* (2010); Choudhari and More (2002) in cucumber; Jan *et al.* (2000) in Bottle gourd and Sanap *et al*. (2010) in bitter guard.

Conclusion :

Fertigation had positive effect on growth and yield of watermelon as it enhanced watermelon production. Amongst different levels of fertigation, application of 100% of fertigation through drip line followed by 80% of fertigation were the optimum doses for getting maximum production of watermelon per hectare.

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