

Improving Strawberry Productivity and Quality Through Drip Irrigation and Polythene Mulch in Bihar

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Abstract

Field trial was conducted under research project in the farmers' field in the Bhojpur district of Bihar on clay loam soil to improve strawberry (*Fragaria ananassa*) productivity and quality through drip irrigation and polythene mulch and to enhance water productivity through pressurized irrigation coupled with use of black polythene mulch along with surface irrigation. Drip irrigation with polythene mulch gave significantly highest yield (50.10 q/ha) as compared to surface irrigation in an unmulched condition (40.15 q/ha) however, the yield under paddy straw (45.90 q/ha) and unmulched (42.07 q/ha) was next in order to drip with polythene mulch but were significantly at par among themselves. When calculated the percentage increase the drip with polythene mulch gave 25% higher yield than surface with unmulched condition. Similarly, the water use efficiency (WUE) was highest in drip irrigation with polythene mulch (7.7 kg/ha/mm) as compared to surface irrigation (5.1 kg/ha/mm). The fruit yield of strawberry under drip irrigation was found to be 46.07 q/ha compared to 40.15 q/ha under surface irrigation. Moreover, polythene mulch plus drip irrigation further raised the yields. Fruit weight increased significantly while other analyzed quality characteristics did not differ significantly among treatments. Drip irrigation besides giving a saving of 50--55% irrigation water resulted in 20--40% higher yield of crops studied.

Key words : Strawberry, Drip irrigation, Water use efficiency, Mulch, Black polythene.

Micro i.e., drip irrigation system has proved its superiority over other conventional methods of irrigation, especially in horticultural crops (fruit crop), owing to precise and direct application of water in the root zone. A considerable savings in water and fertilizer use besides increased growth, development and yield of vegetable crops under drip irrigation have been reported (1, 2). The use of black polythene mulch in fruit and vegetable crops has been reported to control the weed incidence, reduce nutrient losses and improves the hydro-thermal regime of soil (3, 4). Strawberry, being a shallow rooted plant requires more frequent but less amount of water for each irrigation, which can be accomplished more efficiently through drip system. The consequences of drip irrigation in this crop have not yet been completely established. The present studies were therefore, undertaken to evaluate the effect of drip irrigation alone and in conjunction with polythene mulch compared to surface irrigation on water use efficiency, yield and quality of strawberry. The use of black polythene mulch in strawberry has been reported to control the weed inci-

dence, reduce nutrient losses and improves the hydro-thermal regime of soil. Strawberry, being a shallow rooted plant requires more frequent but less amount of water for each irrigation, which can be accomplished more efficiently through drip system. Considering the additional cost of inputs and the selling price of the quality produce, the polythene mulch with drip irrigation may be recommended to the more progressive farmers for cultivation of strawberry in Bihar, however grass mulch can also be used to make technology more resource crunched farmer friendly intervention for cultivation of strawberry especially under Bihar socio-economic condition.

The strawberry is the most profitable fruit crop in the shortest possible time as compared to other fruits. By spending 10 lakhs / ha one can get a receipt of Rs 20 lakh / ha in strawberry. It can be grown on any type of soil, poor sand to heavy clay provided proper moisture organic matter and drainage is present. It is a short day plant (about 10 days of less than 8 hours sunshine for initiation of flowering). In winter, the plants do not make any growth and remain

Table 1. Effect of irrigation and mulch treatments on fruit and dry matter yield and quality characteristics of strawberry fruits.

Treat-ments	Fruit yield (q/ha)	Run-ner pro-duc-tion/plant	Berry wei-ght (g)	Total solu-ble solids (%)	Acid-ity (%)	TSS/ Acid ratio
T ₁	40.15	11.3	5.6	7.17	0.82	8.79
T ₂	41.54	07.7	6.8	6.74	0.71	9.28
T ₃	43.64	7.75	6.3	6.99	0.78	9.01
T ₄	42.07	16.6	6.1	7.06	0.80	8.78
T ₅	45.90	11.5	8.4	6.66	0.70	9.50
T ₆	50.10	12.3	7.0	6.86	0.71	9.57
CD ± (5%)	56.00	1.2	0.3	0.27	0.08	0.87

dormant. In spring, when days become longer and temperature rises, the plants resume growth and begin flowering.

Methods

A field trial was conducted under farmer's participatory research project in the farmers' field in the Bhojpur district of Bihar, on clay loam soil exhibited the following characteristics pH 6.43, E. C. 0.13 dS/m, organic carbon 0.86%. The available N, P and K were 203.06; 551.6 and 14.73 kg/ha respectively with objectives to improve strawberry (*Fragaria ananassa*) productivity and quality through drip irrigation and polythene mulch and to enhance water productivity through pressurized irrigation coupled with use of black polythene mulch along with surface irrigation. Treatments comprised of two irrigation schedules (drip and surface irrigation) and three mulches viz., black polythene (25 micron), paddy straw (4.0 t/ha) and unmulched conditions. These treatments were tested in 2 m × 2 m raised bed plots (each plots consisted of 10 beds) arranged in randomized block design with six replications, viz. T₁ = Surface irrigation (SI) + unmulch; T₂ = SI + paddy straw; T₃ = SI + BP mulch; T₄ = Drip irrigation (DI) + unmulch; T₅ = DI + paddy straw; T₆ = DI + BP mulch.

Results and Discussion

Crop Yield

The data on strawberry fruit indicate that the

Table 2. Quality of water applied and water use efficiency of strawberry under various treatments.

Treat-ments	Water use efficiency (kg / ha / mm)		
	First year	Second year	Pooled
T ₁	3.8	3.6	3.7
T ₂	4.9	4.6	4.7
T ₃	6.3	5.9	6.1
T ₄	6.2	6.7	6.5
T ₅	7.7	7.9	7.8
T ₆	10.5	10.3	10.4
CD = (5%)	1.2	1.7	1.5

drip irrigation without mulch increased the fruit yield by about 21.0 and 9.0% over surface irrigation (Table 1). The corresponding values with paddy straw mulch were 15 and 10%. Maximum fruit yield was observed under drip with BP mulch and increase in yield of 22%, over the surface irrigation plus BP mulch. These results are in accordance with the findings of Rolbiecki et al. (5) who observed higher strawberry yield under drip compared to surface irrigation. Both the mulches were found to be effective in increasing the yield over un-mulch treatment. Surface irrigation with paddy straw and BP increased the yield by about 18 and 37% respectively, over the un-mulch plots (Table 1). The higher yields observed under different mulches may be explained in the light of results reported by Raina et al. (4). They observed that the paddy straw and polythene mulches are effective in altering the soil hydrothermal regimes, thus providing a favorable soil environment for enhanced root/shoot growth and the nutrient uptake by strawberry. Higher yield under mulch treatments may be ascribed to its favorable effects on weed control.

Drip irrigation with polythene mulch gave significantly highest yield (50.10 q/ha) as compared to surface irrigation in an unmulched condition (40.15 q/ha) (5.01 t/ha), however, the yield under paddy straw (45.90 q/ha) and unmulched (42.07 q/ha) was next in order to drip with polythene mulch but were significantly at par among themselves. When calculated the percentage increase the drip with polythene mulch gave 25% higher yield than surface with unmulched condition. The use of black polythene mulch in strawberry has been reported to control the weed incidence, reduce nutrient losses and improves the hydro-thermal regime of soil. Strawberry, being a

shallow rooted plant requires more frequent but less amount of water for each irrigation, which can be accomplished more efficiently through drip system. Polythene especially black polythene mulch contributed significantly to control leaf spot disease. Higher yield under mulch treatments may be ascribed to its favorable effects on weed control. Quality fruits were harvested due to infestation free crop. Result shows that there was 85% weed control was achieved under black polythene mulch as compare to weedy check plot. Mulching could save precious laborer as it requires frequent weeding at 15 days interval during the growing season. Considering the additional cost of inputs and the selling price of the quality produce, the polythene mulch with drip irrigation may be recommended to the more progressive farmers for cultivation of strawberry in Bihar. However, grass mulch can also be used to make technology more resource crunched farmer friendly intervention for cultivation of strawberry especially under Bihar socio-economic condition. The corresponding figures for water savings and increase in yield for strawberry were 51 and 19% respectively. The results further document that irrigation requirement of strawberry can be met effectively by operating the drip system having discharge rate of 4 liter/h biweekly during the growing season.

Strawberry Runner Production

Drip irrigation without mulch and with paddy straw mulch significantly increased the runner production. However, with drip plus BP mulch it was reduced significantly compared with surface irrigation (Table 1). Since the black polythene could not provide an anchor for the roots of the new runners, this impeded their production. It is therefore, suggested that after crop harvest, black polythene be removed to provide favorable soil environment for higher runner production.

Quality Characteristics

Maximum fruit weight (8.39 g/fruit) was recorded under drip plus paddy straw treatment. It may be attributed to the fact that under paddy straw treatment, number of flowers and fruits was less than those under BP mulch (4). Drip plus paddy straw produced

fruit with higher TSS / acidity ratio. In strawberry, drip irrigation without mulch increased the fruit weight by about 6% over surface irrigation and when coupled with paddy straw and BP, the corresponding increase was 32 and 16% respectively (Table 1).

Water Use Efficiency

The corresponding values for drip plus paddy straw and surface irrigation plus paddy straw were 6.8 and 4.7 kg/ha/mm and these values for drip plus polythene mulch and polythene mulch plus surface irrigation were 7.7 and 5.1 kg/ha/mm respectively. Highest water use efficiency of 7.7 kg/ha/mm was observed under drip plus black polythene mulch (Table 2). Drip system delivers water directly into the root zone without wetting the entire area. The probably resulted in higher water use efficiency compared to surface irrigation. Drip irrigation, both with and without polythene mulch registered higher water use efficiency (WUE) as compared to surface irrigation. Averaged overall level of irrigation, drip irrigation, without mulch gave water use efficiency of 5.5 (kg/ha/mm) against 3.7 (kg/ha/mm) under surface irrigation (Table 2).

Conclusion

Drip system is very effective and efficient method of irrigation for raising strawberry crop, especially on light texture soils and in water scarce areas. The corresponding figures for water savings and increase in yield for strawberry were 51 and 19% respectively. The results further document that irrigation requirement of strawberry can be met effectively by operating the drip system having discharge rate of 4 liter/h biweekly during the growing season.

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