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YIELD AND YIELD ATTRIBUTES OF BHINDI AS INFLUENCED BY MULCHING AND METHODS OF IRRIGATION

Bhindi (*Abelmoschus esculentus* L. Moench) is an important warm season vegetable cultivated in India. Its adaptability to a wide range of soil and climatic conditions, comparably easy agronomy and feasibility for its round the year cultivation, has made bhindi a popular vegetable in Kerala. Drip is a better system of irrigation than furrow method for bhindi and gives improved fruit yield by 36 per cent (Gorantiwar *et. al.*, 1991). Reports indicated that mulching in crops improved its growth and yield and enhanced conservation of moisture in the field (Gutal *et. al.*, 1992; Larios *et. al*, 1994). Modern agronomic techniques are yet to be evaluated in the production and productivity in bhindi. Hence mulch-cum-drip irrigation technique was used in bhindi for testing and working out its feasibility for large-scale introduction in this crop.

The experiment was conducted in randomized block design with three replications in summer rice fallow at the Agricultural Research Station, Mannuthy, Thrissur during 1997. The location experienced typical tropical monsoon climate. The soil was sandy clay loam, with a pH of 5.6, medium in organic carbon and available potassium and high in available phosphorus. The ten treatments comprised of combinations of three irrigation systems (drip irrigation with and without mulch and furrow irrigation with mulch) and three irrigation levels (irrigation at soil moisture tensions of 0.04, 0.06, 0.08 MPa) plus furrow irrigation at 0.06 MPa without mulch as control. Drippers having a discharge rate 4 1 h^{-1} were used. The depth of irrigation was 30 mm. Black LDPE sheets of 200 gauge were used as mulch material. Bhindi crop variety Pusa Savani was raised at a spacing of 60 cm x 30 cm in gross plots of size 360 cm x 360 cm. The crop received 254.6 mm rainfall during its growth in the field. The yield and yield attributes such as number of fruiting branches $plant^{-1}$, number of flowers $plant^{-1}$, number of fruits plant" , fruit set % and weight of fruits $plant^{-1}$ and ha^{-1} were recorded during the course of investigation and are given in Table 1. The consumptive use of water by the crop is also given in this table.

Methods of irrigation did not affect number of fruiting branches when the crop was mulched. At the same level of irrigation drip cum mulch and furrow cum mulch enhanced fruiting branches by 99 per cent and 91 per cent respectively over that produced by the control i.e. furrow irrigation at 0.06 MPa.

Number of flowers $plant^{-1}$ followed a similar trend. Drip irrigation without mulching did not enhance flower production over the control treatment i.e. furrow irrigation at 0.06 MPa. When the crop was mulched, it produced 51 per cent more number of flowers under same level of drip irrigation than the control crop. The crop with furrow method of irrigation under mulching produced statistically similar number of flowers $plant^{-1}$ with that of drip irrigation under mulching at soil moisture tension of 0.06 and 0.08. But irrigating the crop at soil moisture tension of 0.04 MPa through furrow irrigation under mulching could not induce as much flower production as that of drip irrigation with mulching.

Once mulching was adopted, the methods and levels of irrigation did not influence fruit production remarkably but in case of furrow irrigation at soil moisture tension of 0.04 MPa caused a lower fruit production. The mulched crop under drip irrigation at 0.04, 0.06 and 0.08 MPa produced 65, 76 and 51 per cent more number of fruits $plant^{-1}$ respectively than the control crop, which produced on an average 13.55 fruits per $plant^{-1}$. The corresponding increase in number of fruits $plant^{-1}$ in furrow method of irrigation under mulching was 20, 56 and 70 per cent.

Mulched crop, irrespective of irrigation levels and methods of irrigation, recorded significantly higher levels of fruit set i.e. on an average 88.1%. Lowest fruit set was recorded in non-mulched drip irrigated crop.

When the crop was mulched, drip and furrow methods of irrigation significantly enhanced fruit yield in terms of total fruit weight by 77 and 63 per cent respectively over that of control crop. Mulched and furrow irrigated crop at 0.08 MPa tension produced maximum fruit yield ha^{-1}, followed by mulched and drip irrigated crop at 0.06 MPa tension. There was no significant

Table 1. Yield attributes, yield and consumptive use of water of bhindi as influenced by mulch cum drip irrigation

Treatments		No. of fruiting branches / plant	No. of flowers / plant	No. of fruits / plant	Fruiting %	Wt. of fresh fruits / plant, g	Fruit yield, t ha^{-1}	CU, mm
T_1	DI at s.m.t. 0.04 MPa	7.38	15.38	11.50	74.10	160.45	8.91	365
T_2	DI at s.m.t. 0.06 MPa	7.27	15.55	10.55	67.13	159.22	8.85	215
T_3	DI at s.m.t. 0.08 MPa	5.83	13.83	10.33	75.16	156.86	8.71	216
T_4	DIM at s.m.t. 0.04 MPa	11.16	25.44	22.39	87.53	427.67	23.59	248
T_5	DIM at s.m.t. 0.06 MPa	11.77	25.66	23.83	92.83	430.37	23.91	184
T_6	DIM at s.m.t. 0.08 MPa	12.94	23.55	20.50	86.63	370.68	20.59	123
T_7	FIM at s.m.t. 0.04 MPa	9.77	18.44	16.33	87.96	352.75	19.60	246
T_8	FIM at s.m.t. 0.06 MPa	11.44	23.38	21.11	85.83	330.97	18.39	183
T_9	FIM at s.m.t. 0.08 MPa	10.83	26.11	23.00	88.03	447.76	24.88	154
T_{10}	Furrow irrigation without mulch (control) at s.m.t. 0.06 MPa	5.99	16.99	13.55	78.80	231.42	12.86	366
CD (0.05)		2.65	5.36	5.39	7.41	131.45	7.30	

effect due to varying levels of irrigation once the crop was mulched. On an average, mulched and drip irrigated crop produced 22.70 tonnes fruits ha , whereas mulched and furrow irrigated crop, produced fruits 20.95 t ha^{-1}, and the control crop produced 12.86 t ha^{-1}.

There was an overall improvement in the yield and yield attributes of bhindi crop when mulching was resorted to, irrespective of method of irrigation. Mulching has been instrumental to enhancing yield in several crops through several factors (Bhella, 1988; Goyal *et. al.,* 1987). Mulching insulated the plant from soil moisture stress as well as other physico-chemical competitive factors in the soil and helped in maintaining good internal water balance in the plant body (Bogle *et. al.*, 1989). When crops were mulched, weed growth was checked and soil moisture losses through evaporation were arrested (Liu *et. al,* 1989). These factors altogether might have contributed for higher yield attributes such as number of fruiting branches, number of flowers, number of fruits, fruit set, weight of fruits plant^{-1} and ultimately the final fruit yield. The irrigation water supplied, irrespective of irrigation methods, was retained in the soil and efficiently distributed for crop growth. This has enabled the crop not to distinguish significantly between the levels of irrigation it received, once the crop was mulched. Higher water use efficiency is an integral part of mulch cum drip irrigation (Battikhi and Ghawi 1987). Reduction in irrigation requirement as well as consumptive use due to mulching at a particular irrigation schedule is a definite advantage of mulching (Goyal *et. al.,* 1987). Sustained moisture supply by drip compared to furrow method in mulched situation has provided a numerical advantage of drip system over furrow method in enhancing yield attributes and yield.

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