International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2021; 9(1): 3128-3130

Received: 01-10-2020
Accepted: 11-11-2020

Lokesha R
Research Scholar, Department of Fruit Science, College of Horticulture, Mudigere, Karnataka, India

Narayanaswamy P
Professor, Department of Horticulture, University of Agricultural and Horticultural Sciences, Shivamogga, Karnataka, India

Girijesh GK
Assistant Professor, Department of Agronomy, College of Horticulture, Shivamogga, Karnataka, India

Suresh D Ekabote
Associate Professor, Department of Plant Pathology, College of Horticulture, Hiriyur, Karnataka, India

Shivakumar BS
Professor and Head, Department of fruit Science, College of Horticulture, Mudigere, Karnataka, India

Corresponding Author:
Lokesha R
Research Scholar, Department of Fruit Science, College of Horticulture, Mudigere, Karnataka, India

Effects of different mulches on yield and water use efficiency of pomegranate cv. Bhagwa

Lokesha R, Narayanaswamy P, Girijesh GK, Suresh D Ekabote and Shivakumar BS

DOI: https://doi.org/10.22271/chemi.2021.v9.i1ar.11707

Abstract
A field experiment entitled "Effects of different mulches on yield and water use efficiency of pomegranate cv. Bhagwa" was conducted. Under this experiment plants were treated with different mulches. Plants treated with black polythene (100 µ) recorded the maximum fruit yield (18.97 kg/plant and 15.81 t/ha), irrigation water use efficiency (10.68 kg/m^3) and water productivity (119.00 l/kg). Silmilary, the same treatment has saved the maximum amount of water (28.71 %). These values were found to be lowest in control treatment (without) indicating the beneficial effect of black polythene.

Keywords: Pomegranate, mulching, black polythene, water use efficiency, water productivity

1. Introduction
Pomegranate (*Punica granatum* L.) belongs to the family Lytheraceae, regarded as `Fruit of paradise', `Anar', 'Fruit of love'. It is an ancient favourite fruit of tropical and sub-tropical regions of the world. It is believed to be originated from Iran and is widely cultivated in Afghanistan, Pakistan, India, China and Mediterranean countries. The fruit is the symbol of `plenty' and referred as' Seed apple'. Edible part of Pomegranate is the juicy outgrowth of seed called aril. Fruits with their sweet acidic taste are used mainly for the table purpose. Pomegranate is rich in carbohydrates, Vitamin C, calcium, iron, carotenoids and antioxidants. Recently, processed products like bottled juice, syrups and jelly made of fruits have high demand in both traditional and international markets. Normally the pomegranate is cultivated in arid to semiarid areas where the problem of water scarcity is observed. However, to increase the quality, yield and water use efficiency application of mulches can be a good idea to conserve the moisture and this would increase the quality and yield. Further, degraded mulch would increase the soil structure to hold more moisture. Keeping in view, these points the present investigations were undertaken.

2. Material and Methods
The field experiment was conducted at farmer's field in T. Nagenalli, Hiriyur taluk of Chitradurga district in Karnataka, India during 2017-18. It is situated in the Central Dry Zone (Zone-4) of Karnataka. The experiment was laid out in Randomized Block Design consisting of ten treatments and three replications. Different treatments are T_1 - Black polythene mulch (100µ), T_2 - Newspaper (1 layer or 15-20 g) T_3 - Arecanut husk (3" thickness or 6 kg/plant), T_4 - Coconut husk (3" thickness or 5 kg/plant), T_5 - Sawdust (3" thickness or 10 kg/plant), T_6 - Maize Stover mulch (3" thickness or 5 kg/plant), T_7 - Leaf litter (3" thickness or 6 kg/plant), T_8 - Peanut hulls (3" thickness or 8 kg/plant), T_9 - Pebbles (1 layer or > 50 kg/plant) and T_{10} - Control (without any mulch). Mulches were applied at plant basin after the pruning. Before mulching entire plant basin was weeded, cleaned and mulched after the pruning. Mulching to the base of the tree around one square meter area was done by using man power and implements. However, organic mulches pour into the soil two to three inches deep within the circle.
Irrigation was started after pruning, drip irrigation is the main irrigation practice followed by the farmers in pomegranate orchard. The daily requirement water is based on climatic condition; it varies from month to month.

However, it was managed to supply 1776.5 liter of water per plant during crop period through drip irrigation at three days interval. The rainfall received during the crop period was about 478 l/sq. meter and fertilizer was applied based on recommended dose (20 to 40 kg FYM/plant/year, 400:200:200 kg/ha $N:P_2O_5:K_2O$ were applied).
The fruit yield (t/ha) was recorded at the time of harvesting. Irrigation water use efficiency, water productivity and amount of water saved were calculated using following formulas;

2.1 Irrigation water use efficiency (kg/m^3)
Irrigation water use efficiency of (IWUE) was calculated by using the formula as here under.

$$\text{IWUE} = \frac{\text{Total yield (kg/fed.)}}{\text{Total applied irrigation water (m/fed/season)}} \times 100$$

2.2 Water productivity (l/kg)
Water productivity is calculated based on amount of fruit (kg) produced by one litre of water. It was determined by the fallowing equation,

$$\text{Water productivity (lit/kg)} = \frac{\text{Fruit yield}}{\text{Litre of water applied}} \quad (1\text{it/kg})$$

2.3 Amount of water saved (%)
Amount of water saved is calculated by using the following equation

$$\text{Water saved} = \frac{\text{Water used in control (1)} - \text{water used in treatments (1)}}{\text{Water used in control (1)}} \times 100$$

3. Results and Discussion
3.1 Fruit yield
The results on effects of different mulches on yield of pomegranate are presented in Table 1. It is evident from the data that different mulch treatments exerted a significant difference on fruit yield (kg/plant and t/ha) of pomegranate. Fruit yield (kg/plant) was highest in the treatment black polythene mulch (18.97 kg/plant) followed by peanut hulls (16.96 kg/plant) and yield per hectare was highest in the treatment black polythene mulch (15.81 t/ha) followed by peanut hulls (14.13 t/ha) compared to other treatments. The minimum yield was observed in control (13.51 kg/pant and 11.26 t/ha, respectively.). These increments of yield on pomegranate are mainly due to the beneficial effects caused by black polythene mulch, such as conservation of soil moisture, regulation of temperature, suppression of weed growth, availability of the nutrients and increase in the fruit size due to better plant growth owing to favorable hydrothermal regime of soil. Similar, kind of beneficial effects due to application of black polythene on growth and yield parameters pomegranate are recorded by Yogaraj *et al.* (2017) [8], El- Taweel and Farag (2015) [2] using gravel mulch in pomegranate cv. Bhagwa and Bakshi *et al.* (2014) [1] in strawberry cv. Chandler.

3.2 Water use efficiency
The present investigations showed that, irrigation water use efficiency, water productivity and amount of water saved varied significantly between the treatments (Table 1).
The irrigation water use efficiency was highest in the treatment black polythene mulch (10.68 kg/m^3) as compared to other treatments while, it was minimum in control (7.61 kg/m^3). This might be due to yield increment under mulching treatments as a result of increasing water availability, decreased weed growth and water evapotranspiration. Drip irrigation with black plastic mulch markedly decreased the amount of water requirement, similarly, drip irrigation along with mulches may be due to excellent soil–water–air relationship with higher oxygen concentration in the root zone and efficient utilization of water and nutrients which increased the irrigation water use efficiency as reported by Kumar and Dey (2011) [4] in strawberry.
The treatment black polythene mulch recorded the highest water productivity (119.00 l/kg) followed by peanut hulls (133.1 l/kg) while, it was lowest in control treatment (166.9 l/kg). This might be due to conserved moisture content of soil in the root zone due to mulching could enhance crop transpiration, nutrient uptake and transportation in the plant body with limited available water. Jha *et al.* (2018) [3] obtained similar results in cauliflower and Meskelu *et al.* (2018) [5] in maize. Similarly, among different mulches black polythene mulch had a beneficial effect on conserving the irrigation water requirement. However, maximum amount of water saved (%) was observed in the treatment black polythene mulch (28.71 %) which was significant over other treatments and it was nil in control treatment. This might be due to increase in yield, conserving more soil moisture, reduced evaporation and better nutrient and water uptake as well as reduced weed population compared to bare soil. The soil is when covered with prevents the runoff and soil loss. It showed that slows down the rainwater runoff, and increased the amount soaking of into the soil. The more water in soil means more water for the crops. Beneficial effects of polythene mulch on water saving is reported by Sakaria *et al.* (2018) [6] in papaya and Shirish *et al.* (2013) [7].

4. Conclusion
From the results of this experiment, it may be inferred that use of black polythene mulch is useful in altering the hydrothermal regime of soil and provided the favorable soil environment for plant growth, yield and water use efficiency of pomegranate than the other mulches. Therefore, use of polythene mulch in pomegranate orchard is found to be more effective due to the durability and congenial effects it has created. Hence, this practice could be recommended to the farmers for their pomegranate orchards to get the higher yield and better income.

Table 1: Effects of different mulches on fruit yield (kg/plant and t/ha), irrigation water use efficiency (kg/m^3), water productivity (l/kg) and Amount of water saved (%)

Treatments	Fruit yield (kg/plant)	Fruit yield (t/ha)	IWUE (kg/m^3)	WP (l/kg)	Amount of water saved (%)
T_1	65.22	19.24	10.68	119.0	28.71
T_2	52.33	12.43	8.40	151.3	9.36
T_3	53.89	12.14	8.42	150.7	9.70
T_4	57.33	13.69	9.25	137.7	17.51
T_5	60.11	12.78	8.64	147.1	11.89
T_6	54.56	12.89	8.82	144.6	13.40

T_7	52.11	13.15	8.88	143.3	14.15
T_8	60.89	14.26	9.54	133.1	20.26
T_9	48.44	12.97	8.76	145.4	12.89
T_{10}	47.11	11.91	7.61	166.9	00.00
S. Em. ±	2.12	0.58	0.28	4.46	-
CD @ 5%	6.29	1.71	0.85	13.27	-

Legend

T_1- Black polythene mulch (100 µ)
T_2- Newspaper (1 layer)
T_3- Arecanut husk (3" thickness)
T_4- Coconut husk (3" thickness)
T_5- Sawdust (3" thickness)
T_6 - Maize Stover mulch (3" thickness)
T_7 - Leaf litter (3" thickness)
T_8- Peanut hulls (3" thickness)
T_9- Pebbles (1 layer)
T_{10}- Control (without mulch

*WP – Water productivity, IWUE – Irrigation water use efficiency

References

1. Bakshi P, Bhat DJ, Wali VK, Sharma A, Iqbal M. Growth, yield and quality of strawberry (*Fragaria x ananassa* Duch.) cv. Chandler as influenced by various mulching materials. African J Agri. Res 2014:9(7):701-706.
2. EL-Tawell AA, Farag AA. Mulching implication on productivity and fruit quality of pomegranate growth in sandy soil. Egyptian J Hort 2015;42(1):367-391.
3. Jha BK, Naik SK, Choudhary JS. Efficacy of planting methods and mulching under drip irrigation on yield, water use efficiency, water productivity and economics of cauliflower (*Brassica oleracea var. botrytis*), Indian. J Agri. Sci 2018;8(2):39-48.
4. Kumar S, Dey P. Effects of different mulches and irrigation methods on root growth, nutrient uptake, water-use efficiency and yield of strawberry, Scientia Horticulturae 2011;127:318-324.
5. Meskelu E, Tesfaye H, Debebe A, Mohammed M. Integrated effect of mulching and furrow methods on maize yield and water productivity at Koka, Ethiopia. Irrigated Drainage Sys Eng 2018;7(1):1-7.
6. Sakariya KK, Satasiya RM, Satasiya VD, Sapariya PS. Performance of Plastic Mulch on Papaya Crop. Int. J Curr. Microbiol. App. Sci 2018;7(03):3243-3251.
7. Shirish SP, Tushar SK, Satish AB. Mulching: A Soil and Water Conservation Practice Research Journal of Agriculture and Forestry Sciences 2013;1(3):26-29.
8. Yogaraj S, Patil DR, Madhushree M. Effect of various mulch on growth and yield of pomegranate cv. Bhagwa. Int. J Agri. Sci. and Res 2017;7(3):103-108.