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Effect of different mulches and liquid organic: Inorganic formulations on flowering and growth of papaya (*Carica papaya* L.) cv. GJP-1

Vrutti Patel and MV RamdevputraDOI: <https://doi.org/10.22271/chemi.2021.v9.i2k.11912>**Abstract**

The present experiment entitled “Effect of different mulches and liquid organic- inorganic formulations on flowering and growth of papaya (*Carica papaya* L.) cv. GJP-1” was carried out at Fruit Research Station, Madhadi Baug, Department of Horticulture, Junagadh Agricultural University, Junagadh during the year 2018-2019 and 2019-2020. The experiment was laid out in Randomized Block Design with Factorial concept (FRBD) consisting two factors as well as one control with three replications. The treatment comprised with two mulches and five treatment of liquid organic-inorganic formulations. The results indicated that black polythene mulch with 100% RDF + Panchgavya @ 1% + Jivamrut @ 250 l/ha + Amritpani @ 250 l/ha improved flowering and growth characters viz., days to flowering, days to fruit set, plant height, number of leaves per plant, bearing height and stem girth.

Keywords: Mulches, liquid organic-inorganic formulations, papaya, GJP-1**Introduction**

Papaya (*Carica papaya* L.) is one of the most important delicious fruit crop grown in the tropical and subtropical parts of the world belongs to the caricaceae family. There is wide diversity of biological types of cultivated papaya, which may be dioecious, monoecious and hermaphrodite (Arrilia *et al.*, 1980) [2]. It owes its popularity to various simple reasons like, it requires less area per tree, comes to fruiting within a year, easy to cultivate and has a high nutritive and medicinal value. Papaya is rich source of several natural compounds like, alkaloids, Pectins, volatile compounds, proteolytic enzymes and growth inhibitors besides papain (Ram, 2005) [13]. Papaya is the highly nutrient exhaustive fruit crop because of its quick growth, continuous fruit bearing habit and heavy fruit yield. It is also sensitive to water logging condition. However, continuous application of huge amount of chemical fertilizers hamper the soil health and biological environment (Kumar *et al.*, 2010 and Tandan, 2000) [8, 19]. So, to tackle such situation, improved production technology on papaya such as, water management through drip irrigation, fertigation, crop geometry, plastic mulching and tissue culture techniques etc., have been developed for different agro-climatic regions of the country (Singh and Singh, 2002) [16]. Mulching is a one of the conventional tool in precision farming which maintain the soil temperature, restrict the loss of soil moisture, suppress the weed growth, conservation of soil from erosions, reduction of soil salinity, improvement of soil structures, improves water infiltration rate by creating hindrance in flow of water, control of pest and diseases enhance microbial activity in the field. Inorganic fertilizers are one of the most expensive inputs in orchard management. So, conjunctive use of chemical fertilizers, cow based bio-enhancers and organic fertilizers sustain crop production and maintain soil health. Cow based bio-enhancers like panchagavya, jivamrut and amritpani has potential to play the role in promoting growth and providing immunity in plant system. However, biofertilizers also offer an alternative to chemical inputs, which have an ability of mobilizing the nutritionally important elements from non-useable to useable form through chemical processes and known to increase yield (Alarcon *et al.*, 2002) [1]. Banana pseudostem sap contains good amount of essential macro and micronutrients as well as growth boosters which increase growth, yield and quality of crop. Moreover, seaweed extracts act as biostimulants mainly due to the presence of phytohormones like auxins, cytokinins, gibberelins, abscisic acid and ethylene.

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These extracts enhance seed germination, growth, yield and uptake of nutrients by the plants.

Materials and Methods

The experiment was carried out at the Fruit Research Station, Madhadi baug, Department of Horticulture, Junagadh Agricultural University, Junagadh, during the year 2018-2019 and 2019-2020. The experiment was conducted with two treatments of mulches viz., silver polythene mulch (M1) and black polythene mulch (M2) and five treatments of liquid organic - inorganic formulations viz., 100% RDF + Panchgavya @ 1%+ Jivamrut @ 250 l/ha +Amritpani @ 250 l/ha (F1), 80% RDF + Panchgavya @ 2%+ Jivamrut @ 500 l/ha +Amritpani @ 500 l/ha (F2), 80% RDF + Panchgavya @ 2%+ Jivamrut @ 500 l/ha +Amritpani @ 500 l/ha + (Azo.+PSB +KMB) Each @ 15 ml/ plant (F3), 60% RDF + Panchgavya @ 3%+ Jivamrut @ 600 l/ha +Amritpani @ 600 l/ha + Banana Pseudostem Sap @ 1% (F4), 60% RDF + Panchgavya @ 3%+ Jivamrut @ 600 l/ha +Amritpani @ 600 l/ha + Sea Weed Extract @ 3% (F5) as well as one control in Randomized Block Design with Factorial concept (FRBD). In control, 100% RDF (200 N: 200 P2O5: 250 K2O g/plant) applied in three equal splits in the form of A.S, SSP and MOP at 2, 4, 6 months after transplanting. The treatments were replicated thrice. The healthy seedlings of 60 days age having uniform girth and almost equal heights were selected and three seedlings were planted in each pit at a distance of 2.0 m x 1.5 m. Black and silver plastic mulch then spread on the soil surface. 100%, 80%, 60% RDF apply with fertigation in the form of urea, phosphoric acid and Muriate of potash in 12 equal splits at 45 DATP (Days after Transplanting) at 20 days interval. Bio-fertilizers apply with fertigation, panchgavya, sea weed extract and banana pseudostem sap apply with foliar spray and Jivamrut and Amritpani apply with drenching method at 2 months interval starting from 2nd month after transplanting up to 10 months. The observations on flowering and growth characters were recorded and analysed statistically.

Results and Discussion

The data revealed that application of different treatment of mulches produced significant effect on flowering and growth parameters viz., days to first flowering, days to fruit set, plant height, number of leaves per plant, bearing height and stem girth. Significantly minimum days to first flowering (84.69, 84.87 and 84.78 days), days to fruit set (4.77, 4.90 and 4.83 days) and bearing height (59.53, 60.51 and 60.02 cm), while maximum plant height (161.11, 160.76 and 160.93 cm), number of leaves per plant (30.10, 27.78 and 28.94), and stem girth (30.79, 29.02 and 29.91cm) were registered with black polythene mulch (M2) during year 2018-2019, 2019-2020 and pooled, respectively. However, silver polythene mulch (M1) noted maximum days for first flowering (89.12, 88.69 and 88.91 days), days required for fruit set (4.77, 4.90 and 4.83 days), bearing height (63.18, 64.30 and 63.74 cm) and minimum plant height (153.23, 152.56 and 152.90 cm), number of leaves per plant (28.16, 26.05 and 27.10) and stem girth (29.16, 27.47 and 28.31 cm). It may be due to the mulching changing the micro-climate by conserving more moisture through reducing evaporation, modifying soil temperature, controlling weeds which increase nutrient availability to the plant and resulted in better plant growth. These results are in conformity with the findings of Mirza *et al.* (2019) [10] in papaya, Bakshi *et al.* (2014) [3] and Gupta and Acharya (1993) [6] in strawberry, Dutta and Majumder (2009) [5] and Khan *et al.* (2013) [7] in guava.

The data presented in Table 1 concealed that, liquid organic-inorganic formulations influenced significantly on flowering and growth parameters viz., days to first flowering, days to fruit set, plant height, number of leaves per plant, bearing height and stem girth. Significantly minimum days to first flowering (80.64, 81.87 and 81.25 days), days to fruit set (4.40, 4.60 and 4.50 days), bearing height (56.14, 58.50 and 57.32 cm) and maximum plant height (164.76, 169.79 and 167.27 cm), number of leaves per plant (31.62, 29.31 and 30.47) and stem girth

Table 1: Effect of different mulches and liquid organic - inorganic formulations on flowering and growth of papaya (*Carica papaya* L.) cv. GJP-1 (Pooled data)

Treatments	Days to first flowering			Days to fruit set			Plant height (cm)		
	2018-2019	2019-2020	Pooled	2018-2019	2019-2020	Pooled	2018-2019	2019-2020	Pooled
Mulches									
M ₁	89.12	88.69	88.91	5.05	5.15	5.10	153.23	152.56	152.90
M ₂	84.69	84.87	84.78	4.77	4.90	4.83	161.11	160.76	160.93
S.Em.±	1.21	1.19	0.85	0.09	0.08	0.06	2.58	2.51	1.80
C.D. at 5%	3.56	3.50	2.42	0.26	0.24	0.17	7.60	7.41	5.14
Liquid organic-inorganic formulations									
F ₁	80.64	81.87	81.25	4.40	4.60	4.50	164.76	169.79	167.27
F ₂	87.29	87.51	87.40	4.86	4.94	4.90	158.67	154.61	156.64
F ₃	86.32	84.65	85.48	4.74	4.84	4.79	164.04	158.36	161.20
F ₄	92.32	91.79	92.05	5.37	5.44	5.41	144.34	147.59	145.96
F ₅	87.96	88.10	88.03	5.17	5.29	5.23	154.04	152.95	153.49
S.Em.±	1.91	1.88	1.34	0.14	0.13	0.09	4.07	3.97	2.84
C.D. at 5%	5.63	5.53	3.82	0.40	0.38	0.27	12.01	11.72	8.13
C v/s R									
Treatment mean	86.91	86.78	86.84	4.91	5.02	4.97	157.17	156.66	156.91
Control	93.74	94.39	94.07	5.57	5.69	5.63	144.30	142.45	143.37
S.Em±	2.00	1.97	1.40	0.14	0.13	0.10	4.27	4.17	2.98
C.D. at 5%	5.91	5.80	4.01	0.42	0.39	0.28	12.60	12.29	8.53
Interaction (M X F)									
S.Em.±	2.70	2.65	1.89	0.19	0.18	0.13	5.76	5.62	4.02
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV%	5.34	5.25	5.30	6.75	6.15	6.45	6.39	6.26	6.33
Pooled interaction									

Source	Y X M	Y X F	Y X M X F	Y X C v/s R	Y X M	Y X F	Y X M X F	Y X C v/s R	Y X M	Y X F	Y X M X F	Y X C v/s R
S.Em±	1.20	1.89	2.68	2.68	0.08	0.13	0.19	0.19	2.54	4.02	5.69	5.69
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Conti...

Treatments	Number of leaves per plant			Bearing height (cm)			Stem girth (cm)					
	2018-2019	2019-2020	Pooled	2018-2019	2019-2020	Pooled	2018-2019	2019-2020	Pooled			
Mulches												
M ₁	28.16	26.05	27.10	63.18	64.30	63.74	29.16	27.47	28.31			
M ₂	30.10	27.78	28.94	59.53	60.51	60.02	30.79	29.02	29.91			
S.Em±	0.54	0.50	0.37	1.02	1.08	0.74	0.53	0.50	0.37			
C.D. at 5%	1.61	1.47	1.06	3.02	3.20	2.13	1.57	1.48	1.04			
Liquid organic-inorganic formulations												
F ₁	31.62	29.31	30.47	56.14	58.50	57.32	31.61	30.73	31.17			
F ₂	29.09	26.66	27.87	60.76	61.03	60.89	29.95	27.95	28.95			
F ₃	30.19	28.10	29.14	59.42	61.76	60.59	31.28	29.07	30.17			
F ₄	27.26	24.48	25.87	66.72	66.81	66.77	27.88	27.00	27.44			
F ₅	27.49	26.03	26.76	63.71	63.93	63.82	29.15	26.49	27.82			
S.Em±	0.86	0.79	0.58	1.62	1.71	1.18	0.84	0.79	0.58			
C.D. at 5%	2.54	2.33	1.67	4.77	5.05	3.37	2.48	2.34	1.65			
C v/s R												
Treatment mean	29.13	26.91	28.02	61.35	62.40	61.88	29.97	28.25	29.11			
Control	26.10	23.50	24.80	66.40	67.91	67.16	26.66	25.57	26.11			
S.Em±	0.90	0.83	0.61	1.69	1.80	1.23	0.88	0.83	0.61			
C.D. at 5%	2.67	2.44	1.75	5.00	5.30	3.53	2.60	2.45	1.73			
Interaction (M X F)												
S.Em±	1.22	1.12	0.83	2.29	2.42	1.67	1.19	1.12	0.82			
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS			
CV%	7.31	7.27	7.30	6.40	6.67	6.54	6.94	6.94	6.94			
Pooled interaction												
Source	Y X M	Y X F	Y X M X F	Y X C v/s R	Y X M	Y X F	Y X M X F	Y X C v/s R	Y X M	Y X F	Y X M X F	Y X C v/s R
S.Em±	0.52	0.83	1.17	1.17	1.05	1.67	2.35	2.35	0.52	0.82	1.16	1.16
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

(31.61, 30.73 and 31.17 cm) were registered with 100% RDF + Panchgavya @ 1% + Jivamrut @ 250 l/ha + Amritpani @ 250 l/ha (F₁) during year 2018-2019, 2019-2020 and pooled, respectively. Whereas, maximum days required for first flowering (92.32, 91.79 and 92.05 days), days to fruit set (5.37, 5.44 and 5.41 days), bearing height (66.72, 66.81 and 66.77 cm) and minimum plant height (144.34, 147.59 and 145.96 cm), number of leaves per plant (27.26, 24.48 and 25.87) and stem girth (27.88, 27.00 and 27.44 cm) were noted with 60% RDF + Panchgavya @ 3% + Jivamrut @ 600 l/ha + Amritpani @ 600 l/ha + Banana Pseudostem Sap @ 1% (F₄). The improvement in flowering and growth characters might be due to the effective utilization and accurate placement of fertilizers in soluble form at the active root zone area resulting in vigorous growth which ultimately resulted in better vegetative growth. Moreover, cow-based bio-enhancers contains macronutrients such as N, P, K and micronutrients needed for various vitamins, amino acids, growth regulators such as auxins and gibberellins which are required for proper growth and development of plants. These results are in conformity with the findings of Sing and Varu (2013) [17] and Yadav (2006) [20] in papaya and Srinivas (1997) [18], Chandrakumar *et al.*, (2001) [4] and Mahalakshmi *et al.*, (2001) [9] in banana.

In control *vs* rest of the treatment, result show significant effect in vegetative parameters where, significantly minimum days to first flowering (86.91, 86.78 and 86.84 days), days to fruit set (4.91, 5.02 and 4.97 days) and bearing height (61.35, 62.40 and 61.88 cm) while maximum plant height (157.17, 156.66 and 156.91 cm), number of leaves per plant (29.13, 26.91 and 28.02) and stem girth (29.97, 28.25, 29.11 cm) were obtained in treated plant during year 2018-2019, 2019-

2020 and pooled, respectively compared to control. It may be due to the fact that constant and continuous supply of nutrients to the active root zone might have caused minimum time lag between application and uptake of nutrients resulting in better cell turgidity which had led to cell enlargement and better cell wall development thus resulting in better plant vigour. The availability of N and K in the root zone through fertigation might have induced more plant vigour (Raskar, 2003) [14]. Further, mulching might have helped in attaining optimum growth through controlling of weeds, conserving soil moisture and maintenance of optimum soil temperature. These results are more or less similar to those reported by Prajapati *et al.* (2017) [12] in papaya, Nirala and Suresh (2020) [11] and Santosh and Tiwari (2017) [15] in banana.

The interaction effect between different treatments and its combinations were observed non-significant to all flowering and growth parameters.

Conclusion

From the foregoing discussion it can be concluded that black polythene mulch with 100% RDF + Panchgavya @1% + Jivamrut @ 250 l/ha + Amritpani @ 250 l/ha improved flowering and growth of papaya (*Carica papaya* L.) cv. GJP-1.

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