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Effect of partial root drying technique and fertigation on pest and diseases of pomegranate (*Punica granatum* L.) Cv. Bhagwa

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Abstract
A investigation was conducted to study the effect of partial root drying technique and fertigation on major pest and diseases of pomegranate (*Punica granatum* L.) Cv. Bhagwa was carried out through a field experiment. The experiment comprising of 8 treatments, T_1 is a partial root drying technique that requires 100% water and 100% nutrition (NPK); T_2 is a partial root drying technique that requires 100% water and 75% nutrition (NPK); T_3: Half-drying method (75% water needed) + 100% nutrition through fertigation using 100% RDF of NPK; T_4: Half-drying method (75% water needed) + 75% nutrition through fertigation using 75% RDF of NPK; T_5: 50% water need for partial root drying + 100% nutrition through fertigation with 100% RDF of NPK, T_6: 50% water need for partial root drying + 75% nutrition through fertigation with 75% RDF of NPK, T_7: Management, or standard drip irrigation (requiring 100% water) and 100% nutrition through fertigation using 100% RDF of NPK, T_8: Control, or standard drip irrigation with 100% water need on both plant sides with 75% nutrition through fertigation using 75% RDF of NPK. In pooled data of two years, minimum incidence of bacterial blight (5.28%) and fusarium wilt (6.24%) was observed in I_1 (PRD_{100}) and I_2 treatment (PRD_{75}). Minimum incidence of bacterial blight (5.81%) and fusarium wilt (14.55%) was recorded in N_1 treatment (RDF_{100}). The minimum incidence of bacterial blight (5.15%) and fusarium wilt (4.16%) was noticed in T_5 treatment. Coming to pest infestation, minimum fruit borer incidence (3.65%) and aphid incidence (7.74%) was observed in I_3 (PRD_{50}). Minimum fruit borer incidence (4.50%) and aphid incidence (9.61%) was recorded in N_2 treatment (RDF_{75}). In interaction effect of fertigation and irrigation, the minimum fruit borer incidence (3.51%) and aphid incidence (7.65%) was noticed in T_6 treatment.

Keywords: Pomegranate, PRD, Bhagwa, pest, drought, diseases

Introduction
The pomegranate, or *Punica granatum* L., is a significant fruit crop that thrives in desert and subtropical areas because of its resilience to harsh weather and soil. It is thought to have originated in South-West Asia, most likely in Iran, and is a member of the Lythraceae family. Its chromosomal numbers are 2n = 16 and 18. Due to its exceptional mix, remarkable dessert quality, and sweet-acidic taste, it is one of the most widely consumed commercial fruits worldwide. The fruit's organoleptic qualities, or the seeds' ability to cure leprosy, cancer, and other ailments, as well as its nutritional value and medicinal properties, are further reasons for its popularity (Sonawane, 2017) [7]. Pomegranates are currently grown in 2.62 lakh hectares of land in India, where they produce 30.34 lakh MT. The top pomegranate-producing states are Maharashtra, Karnataka, Andhra Pradesh, Gujarat, and Tamil Nadu. (Anon., 2021) [1]. Pomegranates are typically irrigated commercially using drip irrigation, which is the most efficient way to provide water to the plants for their consumptive use. However, because pomegranates are a highly drought-tolerant crop, growers can save even more water by implementing innovative irrigation techniques like partial root drying, which is a sustainable method that saves water without compromising fruit quality or yield. This innovative irrigation method involves watering just half of the plant's root system, leaving the other half dry and the soil moist. This allows the plant to take water from one portion of the root system while leaving the other dry until the next irrigation cycle.

Pomegranates grow heavily in sub-tropical climates, which can exhaust the plant and deplete vital soil nutrients necessary for healthy growth and development. Drip irrigation is used in the fertilization process to provide plants with water-soluble solid or liquid fertilizers. Due to its simplicity, efficiency, and ease of maintenance of the ideal fertility level and water supply in accordance with the particular demand to nourish the crop adequately to promote growth and productivity without adversely affecting the environment, this method of applying fertilizer is the most widely used. In addition to reducing labor costs for external application, fertilization increases the capacity of the root mass to retain and trap water and nutrients, hence improving the efficiency of both nutrient and water usage. Additionally, it makes it possible to precisely and accurately distribute nutrients at crucial periods of crop growth.

Materials and Methods

The current study was conducted in the Fruit Orchard, Sector 70, UHS, Bagalkot, pomegranate orchard, to examine the impact of fertigation and partial root drying technique on soil nutrients of pomegranate (*Punica granatum* L.) Cv. Bhagwa in the years 2019–2020 and 2020–2021. Situated at 16. 10° N latitude and 75.42° E longitude, the area is under Karnataka's Northern Dry Zone (Zone-3), and it is 542.00 m above Mean Sea Level (MSL). The experiment was set up as a two-factor RCBD, with 24 plots total. The first factor had four distinct irrigation treatments, and the second factor had two different fertigation treatments. Both factors were reproduced three times. The treatment details include**.**

Main treatments

1. I_1: Partial root zone irrigation technique to replenish 100% CP_E (100% water requirement)
2. I_2: Partial root zone irrigation technique to replenish 75% CP_E (75% water requirement)
3. I_3: Partial root zone irrigation technique to replenish 50% CP_E (50% water requirement)
4. I_4: Control *i.e.* normal drip irrigation on both sides of the plant to replenish 100% CP_E (100% water requirement)

Sub treatments

1. N_1: 100% nutrition by fertigation with 100% RDF of NPK (400:200:200 g /plant)
2. N_2: 75% nutrition by fertigation with 75% RDF of NPK (300: 150:150 g /plant)

Calculation of water requirement of the crop: Based on CPE, using FAO Penman- Monteith method (http://wwww.fao.org or https://aggiehorticulture.tamu.edu)

The percent incidence of fruit borer was calculated by dividing number of fruits infested per plant by total number of fruits borne on individual plant, then multiplied with 100 (Vanitha, 2018) [8]. Aphid population was estimated by counting aphid population per three shoots (terminal tip of 5 cm) on 15 randomly selected tagged shoots on four sides at fortnight after each spray as acaricides. Later, mean number of insects was computed (Rajeshwari, 2016) [5]. Bacterial blight infestation was accessed by dividing of number of infected fruits / plant with Total No. of fruits / plant and multiplied with 100. (Lalithya, 2017) [4]. Further, Fusarium wilt infestation was measured by dividing the number of infected plants with total number of fruits and then multiplied with 100. (Ganesh, 2016) [2]

Results and Discussion

The interpretation of data revealed significant difference for values fruit borer incidence among four different irrigation and its interaction effect with fertigation, while fertigation treatment alone did not vary significantly (Table 1). As shown in pooled data of two years, maximum fruit borer incidence was recorded in I_4 treatment (CDI_{100}) followed by I_1 *i.e* PRD_{100}. Whereas, minimum fruit borer incidence (3.65%) was observed in I_3 (PRD_{50}). This reduced incidence of fruit borer in mild and severe water stressed irrigation regime especially under PRD irrigation regime attributed to combined effect of higher rind thickness and higher tannin and phenols content in rind resulted in reduced preference for the pests by the host plants. Further, reduced relative humidity inside the plant canopy due to reduced canopy cover by allowing maximum sunlight and rise in canopy temperature also responsible for reduction of incidence. Among the fertigation treatments, maximum fruit borer incidence was recorded in N_1 treatment (RDF_{100}) and this might be due to higher relative humidity inside the canopy due to more vegetative growth. Coming to aphid population, The interpretation of data revealed significant difference for values of aphid incidence among four different irrigation and its interaction effect with fertigation, while fertigation treatment alone did not vary significantly (Table 1). Among the fertigation treatments, maximum aphid incidence (9.89%) was recorded in N_1 treatment (RDF_{100}). This reduced incidence of aphid in mild and severe water stressed irrigation regime especially under PRD irrigation regime attributed to higher tannin and phenols content in leaves and shoots resulted in reduced preference for the pests by the host plants. Further, reduced relative humidity inside the plant canopy due to reduced canopy cover by allowing maximum sunlight and rise in canopy temperature also responsible for reduction of incidence. In pooled data of two years, maximum aphid was recorded in I_4 treatment (CDI_{100}) followed by I_1 *i.e* PRD_{100}. Whereas, minimum aphid incidence (7.74%) was observed in I_3 (PRD_{50}). With respect to bacterial blight infestation, the interpretation of data revealed significant difference for values of bacterial blight among four different irrigation and its interaction effect with fertigation in both the years of experimentation. Whereas fertigation treatments did not vary significantly (Table 2).

In pooled data of two years, maximum incidence of bacterial blight was recorded in I_3 treatment (PRD_{50}) followed by I_4 *i.e* CDI_{100}. Whereas, minimum incidence of bacterial blight was observed in I_1 (PRD_{100}) and I_2 treatment (PRD_{75}). Among the fertigation treatments, maximum incidence of bacterial blight (6.12%) was recorded in N_2 treatment (RDF_{75}). The increased resistant to bacterial blight in mild and zero water stress irrigation especially under PRD regime could be attributed to increased uptake of essential nutrients (potassium) by Birch effect and water extraction from soil by enhanced root growth with active feeder roots. Further, optimum reduction in canopy area also reduces congenial microclimate (reduced relative humidity) for disease development inside the canopy. Further, optimum water stress condition especially under PRD is known for enhancing molecular pathway for synthesis of various secondary metabolites such as phenols, tannins, alkaloids and terpenes contributes improved disease resistance in the plant system (Ramírez-Gómez, 2019) [6]. The interpretation of data revealed significant difference for values of fusarium wilt among four different irrigation, fertigation and interaction effect of both irrigation and fertigation (Table 2). In pooled data of two years, maximum incidence of fusarium wilt was recorded in I_4 treatment (PRD_{100}) followed by I_2 *i.e.*, PRD_{75}. Whereas, minimum incidence of fusarium was observed in I_3 (PRD_{50}). Among the fertigation treatments, maximum incidence of fusarium wilt (22.81%) was recorded in N_2 treatment (RDF_{75}). The increased resistant to fusarium wilt in mild and severe water stress irrigation especially under PRD regime could be attributed to, as fusarium is a soil born pathogen and the pathogen is most active in wet soil therefore, the pathogen spread will be reduced in moisture stress condition. Further, optimum water stress condition especially under PRD is known for enhancing molecular pathway for synthesis of various secondary metabolites such as phenols, tannins, alkaloids and terpenes contributes improved disease resistance in the plant system (Ramírez-Gómez, 2019) [6].

Table 1: Fruit borer and aphids incidence as influenced by different irrigation and fertigation in pomegranate *cv*. Bhagwa

Irrigation (I)	Fruit borer (%)									Aphid								
	2019-20			2020-21			Pooled			2019-20			2020-21			Pooled		
	N_1	N_2	Mean	N_1	N_2	Mean	N_1	N_2	Mean	N_1	N_2	Mean	N_1	N_2	Mean	N_1	N_2	Mean
I_1	5.11	4.78	4.95	4.99	4.93	4.96	5.05	4.85	4.95	11.04	10.66	10.85	10.93	10.55	10.74	10.98	10.60	10.79
I_2	4.28	4.01	4.15	4.23	3.95	4.09	4.25	3.97	4.11	8.96	8.70	8.83	8.76	8.56	8.66	8.86	8.63	8.75
I_3	3.82	3.59	3.70	3.76	3.43	3.60	3.79	3.51	3.65	7.86	7.68	7.77	7.80	7.633	7.71	7.83	7.65	7.74
I_4	5.84	5.69	5.76	5.79	5.65	5.72	5.81	5.67	5.74	11.91	11.58	11.75	11.83	11.50	11.66	11.87	11.54	11.70
Mean	4.76	4.52		4.69	4.49		4.73	4.50		9.94	9.65		9.83	9.56		9.89	9.610	
For comparing means of	S.Em. ±	C.D. at 5%		S.Em. ±	C.D. at 5%		S.Em. ±	C.D. at 5%		S.Em. ±	C.D. at 5%		S.Em. ±	C.D. at 5%		S.Em. ±	C.D. at 5%	
Irrigation (I)	0.05	0.17		0.26	0.78		0.09	0.27		0.14	0.45		0.28	0.86		0.11	0.32	
Nutrients (N)	0.04	0.12		0.18	NS		0.13	NS		0.10	NS		0.20	0.61		0.15	0.45	
Irrigation (I) x Nutrients (N)	0.08	0.11		0.36	1.11		0.18	0.54		0.21	0.63		0.40	1.22		0.22	0.64	

PRD: Partial root drying
Factor-II: Two different levels of fertigation
CI- Conventional (Normal two side irrigation)
N_1- RDF_{100}
Factor-1: Four different levels of irrigation (PRD and conventional)
N_2- RDF_{75}
I_1 -PRD_{100}
I_2–PRD_{75}
I_3– PRD_{50}
I_4- Conventional $_{100}$
NS- Non Significant

Table 2: Bacterial blight and Fusarium wilt incidence as influenced by different irrigation and fertigation in pomegranate *cv*. Bhagwa

Irrigation (I)	Bacterial blight (%)									Fusarium wilt (%)								
	2019-20			2020-21			Pooled			2019-20			2020-21			Pooled		
	N_1	N_2	Mean	N_1	N_2	Mean	N_1	N_2	Mean	N_1	N_2	Mean	N_1	N_2	Mean	N_1	N_2	Mean
I_1	5.10	5.43	5.26	5.14	5.38	5.26	5.15	5.40	5.28	8.33	16.61	12.47	16.55	16.61	16.58	12.45	20.80	16.62
I_2	5.28	5.34	5.31	5.27	5.26	5.26	5.27	5.30	5.28	16.61	25.00	20.80	8.33	16.66	12.49	12.46	20.80	16.63
I_3	7.23	7.916	7.57	7.50	7.93	7.71	7.26	7.92	7.59	8.33	8.33	8.33	0.00	8.33	4.16	4.16	8.33	6.24
I_4	5.56	5.86	5.71	5.60	6.61	6.10	5.583	5.85	5.72	33.30	41.66	37.48	25.00	41.66	33.33	29.15	41.33	35.24
Mean	5.79	6.13		5.87	6.29		5.81	6.12		16.64	22.9		12.47	20.81		14.55	22.81	
For comparing means of	S.Em. ±	C.D. at 5%		S.Em. ±	C.D. at 5%		S.Em. ±	C.D. at 5%		S.Em. ±	C.D. at 5%		S.Em. ±	C.D. at 5%		S.Em. ±	C.D. at 5%	
Irrigation (I)	0.49	1.37		0.182	0.50		0.13	0.39		5.91	16.39		6.11	16.96		0.0011	0.002	
Nutrients (N)	0.34	NS		0.12	0.35		0.19	NS		4.18	11.59		4.32	11.99		0.0015	0.003	
Irrigation (I) x Nutrients (N)	0.69	1.93		0.25	0.71		0.27	0.78		8.36	23.18		8.65	23.98		0.0022	0.004	

PRD: Partial root drying
Factor-II: Two different levels of fertigation
CI- Conventional (Normal two side irrigation)
N_1- RDF_{100}
Factor-1: Four different levels of irrigation (PRD and conventional)
N_2- RDF_{75}
I_1 -PRD_{100}
I_2–PRD_{75}
I_3– PRD_{50}
I_4- Conventional $_{100}$
NS- Non Significant

Conclusion

The present study reveals that, Among four different irrigation treatments, minimum incidence of bacterial blight (5.28%) and fusarium wilt (6.24%) was observed in I_1 (PRD_{100}) and I_2 treatment (PRD_{75}). Minimum incidence of bacterial blight (5.81%) and fusarium wilt (14.55%) was recorded in N_1 treatment (RDF_{100}). The minimum incidence of bacterial blight (5.15%) and fusarium wilt (4.16%) was noticed in T_5 treatment. Coming to pest infestation, minimum fruit borer incidence (3.65%) and aphid incidence (7.74%) was observed in I_3 (PRD_{50}). Minimum fruit borer incidence (4.50%) and aphid incidence (9.61%) was recorded in N_2 treatment (RDF_{75}).

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Reference

1. Anonymous. Horticultural statistics at a glance; c2021. http://.nhb.gov.in.
2. Ganesh VC. Studies on wilt complex disease of pomegranate. M.Sc. Thesis submitted to MPKV, Rahuri, Maharstra, India; c2016.
3. http://wwww.fao.org or https://aggiehorticulture.tamu.edu
4. Lalithya KA, Kulkarni MS, Raju B, Manjunatha G, Lokesh V. Plant growth regulators and signal molecules enhance resistance against bacterial blight disease of pomegranate. J Phytopatho. 2017;1:1-10.
5. Rajeshwari G, Chakravarthy AK, Ramegowda GK, Sridhar V, Murthy BNS, Kumar MS. Evaluation of Biorationals against major sucking pests on selected fruit and vegetable crops, M.Sc., Thesis submitted to UHS, Bagalkote, Karnataka; c2016.
6. Ramírez-Gómez XS, Jiménez-García SN, Campos VB, Campos MLG. Plant metabolites in plant defense against pathogens. Plant Dis.-Curr. Threats and Manage. Trends; c2019. DOI: http://dx.doi.org/10.5772/intechopen. 87958.
7. Sonawane MS. Recent advances in the production of pomegranate fruit crop. Agric. Update. 2017;12(4):657-665.
8. Vanitha K. Studies on seasonal incidence and management of pomegranate fruit borer *Deudorix* (=Virachola) Isocrates (Fab.) during Hast bahar. Thesis submitted to UHS, Bagalkote, Karnataka; c2018.