

Effects of Crop Canopy and Rainfall Intensity on Runoff in *Alfisols* of Eastern Dry Zone of Karnataka

Comment [S.1]: Better used :Intensities

ABSTRACT

A field experiment was conducted at Gandhi Krishi Vignana Kendra, University of Agricultural Sciences, Bangalore on stages of crop canopy cover and rainfall intensity as influenced by runoff in *Alfisols* of eastern dry zone of Karnataka during *Kharif 2022*. The study aimed to determine the relationship between rainfall characteristics, crop canopy cover and runoff under various stages of the crop growth period. Five treatments were imposed and tested, the results of the study indicated that the highest canopy cover were recorded under T₁ (Pomelo), T₂ (Castor), T₃ (Pigeon pea), T₄ (Chickpea) and T₅ (control). During the crop season from May to December 2022, there were 34 runoff events across treatments. The highest rainfall, 130.0 mm on May 18, resulted in runoff ranging from 13.72 mm to 26.39 mm across treatments. On June 18, 2022, a rainfall of 104.8 mm led to runoff ranging from 5.46 mm to 20.18 mm. The minimum rainfall of 6.0 mm on October 2 resulted in runoff ranging from 0.46 mm to 1.53 mm. Throughout the season, the Control plot (T₅) had the highest runoff of 259.77 mm, while the Pomelo plot (T₁) had the lowest runoff of 79.39 mm. In Control plots (T₅) had the highest runoff of 259.77 mm due to lack of canopy cover, while Pomelo (T₁) had the lowest runoff of 79.39 mm, correlating with its substantial canopy cover (11.66 m²/tree). Castor (T₂) had runoff of 107.84 mm with 0.37 m²/plant canopy cover, Pigeon pea (T₃) had 125.81 mm runoff with 0.34 m²/plant canopy cover, and Chickpea (T₄) had 177.91 mm runoff with the least canopy coverage (0.01 m²/plant). The crop canopy cover area trend is in the order of Control (T₅) < Chickpea (T₄) < Pigeon pea (T₃) < Castor (T₂) and < Pomelo (T₁).

Comment [S.2]: Before this statement author need to have introduction of the research and also need to highlight the research problem statement.

Comment [S.3]: Before this statement should have the brief explanation of your research methodology (research process, what type of data analysis been used and etc.)

Key words: Runoff, crop canopy, Rainfall, Farm pond and Intensity

Comment [S.4]: After result and discussion. Author need to have the research conclusion.

Comment [S.5]: Author need to simplify the result and discussion... just highlight the result that show the outcome that match your study aim. Maybe you can show the percentage of correlation between the parameter that effect the runoff.

Comment [S.6]: Do you really need to have this keyword?

1. INTRODUCTION

The movement of water and moisture globally, including plant life and the atmosphere, is crucial for the health of humans, flora, and fauna. By evaluating water input and output in a watershed for rainwater management in red soils of dryland regions is very important and water requirement for different human activities particularly in agriculture sector is a crucial and need of the hour which may help to develop low cost location specific socially acceptable strategies for various crops and terrains in the country and state as well. Understanding land use impacts on water balance and runoff remains a key focus in hydrological research may also helping to predict future water availability for agriculture (Todini, 2007; Alemaw and Chaoka, 2003). The systematic estimation and determination of rain water interventions and requirements in drylands as a first step in establishing improved approaches or techniques and tools for influencing policy in water management in drylands. Biological conservation methods are increasingly recognized for their long-term effectiveness and cost-efficiency under dryland areas by developing dense plant hedges with shallow roots reduce velocity of water flow, increasing time of concentration, enhance infiltration, and evenly distribute soil moisture in micro-watersheds apart from boosting crop yields (Krishnappa *et al.*, 1994). Vegetation protects soil from raindrop impact reduce the detachment of soil particles from the soil mass held soil particles tightly by the roots of grass which improves infiltration rate, soil water content, structure, and stability, creating durable macropores (Loch and Orange, 1997). Studies show that increased tree/crop canopy can reduce runoff by up to 62% and the selected suitable land use systems were implemented with conservation measures is essential for cost-effective, location-specific farming practices (Armson *et al.*, 2013). Tree canopies significantly reduce soil erosion and runoff by intercepting rainfall, with agri-horti systems increasing infiltration and agro-forestry reducing runoff (Johnson and Lehmann, 2006). An integrated watershed approach for the management of rain water consists of increasing moisture storage in the soil, optimum use of this moisture through efficient cropping systems, harvesting a portion of the runoff water for "life saving" irrigation, and reorienting the concepts and organization of irrigation, including that from tanks, to enhance productivity per unit of rain water (J S Kanwar, 1982).

Comment [S.7]: Normally any research citation is between 5 years back (from year 2019 till 2024)

Comment [S.8]: Normally any research citation is between 5 years back (from year 2019 till 2024) to show that before 2019 there was researcher has done that research.

Comment [S.9]: Comment same as before

Comment [S.10]: The last sentences in INTRODUCTION, author need to explain why you want to do this research based on your finding from the literature review.

2. MATERIALS AND METHODS

During *Kharif 2022*, a field experiment was carried out at All India Co-Ordinated Research Project for Dryland Agriculture, University of Agricultural Sciences, Bangalore aimed to study and to develop the relationship between rainfall characteristics and runoff under various land surface conditions in red sandy loam soil of Eastern Dry Zone of Karnataka.

Comment [S.11]: Need to briefly explain what is "Kharif 2022" so that reader know the chronology.

2.1 Location of the experimental site

The geographical coordinates of the research site are approximately 12°58' North latitude and 77°35' East longitude, with an elevation of 924 meters above mean sea level. The experimental location falls within the Eastern Dry Zone (Zone – V) of the Agro-climatic zone of Karnataka.

Comment [S.12]: Need explanation of the research duration especially the data collection process.

What is your research parameter?

2.2 Actual climatic conditions

During 2022, the total rainfall of 1556.8 mm of were received and recorded at meteorological station located adjacent to experimental site. The other important weather parameters such as average maximum temperatures ranged from 25.2°C to 33.5°C, and minimum temperatures ranged from 14.8°C to 20.1°C, monthly relative humidity averaged 81% in March to 91% in August. The bright sunshine hours peaked in February (8.7 hrs) and were lowest in July (3.4 hrs) with an average wind speed varied from 3.5 to 6.0 km/hr during the experimental period and open pan evaporation peaking in April (7.1 mm/day) and lowest in July (3.1 mm/day).

Comment [S.13]: To prove this statement author should have Figure research location (map)

2.3 Soil and its characteristics

The soil sample were collected from 0-15 cm depth was collected and analyzed. The soil was a red sandy loam with good drainage, slightly acidic (pH 5.11) and had an electrical conductivity of 0.04 dS/m. The soil of experimental site 0.37% organic matter and had a maximum water holding capacity of 33.61%.

Comment [S.14]: How many soil sample taken and how many point soil sample taken from 5 treatments?

2.4 Details of experiments

The experiment studied runoff in relation to crop canopy growth stages and rainfall intensity to establish a rainfall-runoff relationship. The experimental have five plots accounting 20,304 m² totally consists of first plot T₁ (Pomelo) with 3,226 m², second plot T₂ (Castor) with 5,255 m², third plot T₃ (Pigeon pea) with 5,585 m², fourth plot T₄ (Chickpea) with 5,998 m² and fifth plot T₅ (control, no crop) with 240 m². The layout of experimental plot presented in Fig.-1.

Comment [S.15]: Is the number represent the area of the plot? If yes..need to explain why each plot has different size.

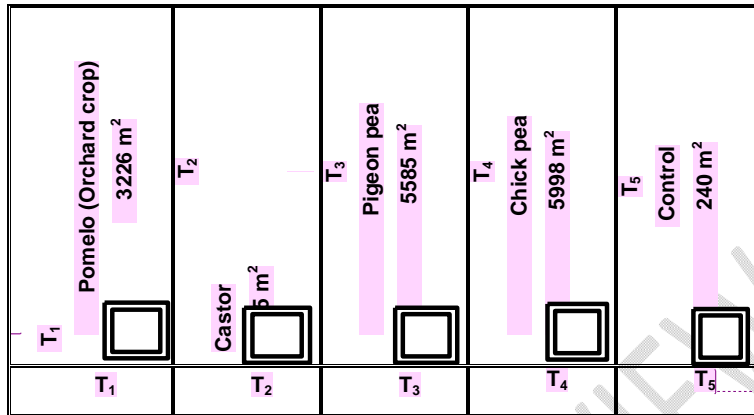


Fig. 1: Plan and layout of experimental site

Comment [S.16]: Need to show the layout of the farm pond..where the location of the farm pond?

2.5 Runoff measurement

The runoff from individual plots collected into the farm pond measured by taking depth of runoff water collected in the farm pond for each runoff event from each micro watershed (treatments) and when the overflow occurred, the amount of overflow was recorded by the automatic stage level recorder were installed at the outlet of the farm pond and volume of overflowed runoff water from the farm pond determined by analyzing hydrograph generated for each overflow water from farm pond and the same is added to obtain total runoff.

Comment [S.17]: This statement should have some figure so that reader understand the process.

2.6 Volume of farm pond

Volume of farm pond = $A + 4B + C \times D$
 Where, A = Top Area (m²), C = Bottom Area (m²),
 B = Middle Area (m²), D = Depth (m).

Comment [S.18]: Is the your own mathematical formula? If NO..the need to have citation of the formula.

2.6.1 Runoff (mm):

Runoff (mm) = Volume (m³) / Catchment area (m²) × 1000

Comment [S.19]: Same comment as before

2.6.2 Runoff (%):

Runoff (%) = Runoff (mm) / Rainfall (mm) × 100

Comment [S.20]: Same comment as before

2.7 Rainwater directly falling on farm pond

Rainwater directly falling on farm pond (mm) =

Rainwater directly collected in farm pond m³ × 1000 / cross sectional area of the farm pond (m²)

Comment [S.21]: Same comment as before

2.8 Density of vegetation

Plant/ Tree density (Plants /ha) = 10000 / Row to Row spacing X (Plant to plant spacing)

Comment [S.22]: Same comment as before

2.9 Crop canopy spread area (cm²)

Plant spread cm² = East-West cm X North-South (cm)

Comment [S.23]: Same comment as before

Comment [S.24]: Sub topic 2.6 can be explain in a paragraph, no need to narrow it into sub sub topic because your explanation here is too short.

3. RESULTS AND DISCUSSION

3.1 Rainfall as influenced by runoff (mm) under different treatments

Comment [S.25]: My suggestion for the sub title: Correlation between rainfall and runoff

In 2022, there were 75 rainy days with a total rainfall of 1556.8 mm, exceeding the normal 941.4 mm. Most of the rainfall (1490.8 mm) occurred from May to December over 71 days, with 34 runoff events. The highest single-day rainfall was 130 mm on May 18, causing the greatest runoff (29.09 mm) in the control plot (T₅). Another significant event on June 18 (104.8 mm) led to runoff, with T₅ again having the highest (22.36 mm). Even minimal rainfall (6.0 mm) on October 2 caused runoff in all treatments, ranging from 0.58 mm to 1.66 mm. On May 19, an 11.0 mm rainfall caused runoff in all treatments except the pomelo plot (Table 1).

3.2 Rain water (mm) directly fall on farm pond and collected in water storage structures

Rain water directly falling on the farm ponds for each rainfall events causing runoff under various treatments are determined for quantifying the actual amount of runoff produced for each event during the cropping season and the data presented in Table 2.

Throughout the entire cropping season, the most substantial rainfall occurred on May 18, 2022, with a record of 130.0 mm rainfall. This led to the direct collection of rainwater measured in cubic meters amounting to 1.05 mm in T₁ and 1.43 mm in T₂, T₃, T₄, and T₅. Following closely, the second-highest rainfall of 104.8 mm on June 18, 2022, resulted in the direct collection of rainwater totaling 0.85 mm in T₁ and 1.16 mm in T₂, T₃, T₄, and T₅. A total of 9.31 mm in T₁ and 12.69 mm was collected in T₂, T₃, T₄, and T₅ farm ponds as throughfall during the entire period of cropping season.

3.3 Actual runoff (mm) under different treatments

During the crop season from May to December 2022, there were 34 runoff events across treatments. The highest rainfall, 130.0 mm on May 18, resulted in runoff ranging from 13.72 mm to 26.39 mm across treatments. On June 18, 2022, a rainfall of 104.8 mm led to runoff ranging from 5.46 mm to 20.18 mm. The minimum rainfall of 6.0 mm on October 2 resulted in runoff ranging from 0.46 mm to 1.53 mm. Throughout the season, the Control plot (T₅) had the highest runoff of 259.77 mm, while the Pomelo plot (T₁) had the lowest runoff of 79.39 mm. Further details are in Table 3.

Comment [S.26]: Should have figures to be show.. Likes Correlation graph

Comment [S.27]: The result should also mention about the cumulative data for the 1 year or rainfall data not just focus on June 18. if you can show the data in term of graph reader can see the rainfall pattern from early year to the end of the year

Comment [S.28]: Same comment as before..need to explain the result cumulative runoff data.

Table 1: Runoff (mm) under different treatments during the cropping season, 2022

Comment [S.29]: It is more proper if this result you show it on a graph.

Sl. No.	Date	Rainfall (mm)	Runoff (mm)				
			T ₁	T ₂	T ₃	T ₄	T ₅
1	15-May	14.0	0.6	0.56	0.9	1.32	2.07
2	17-May	16.4	0.82	3.18	2.89	3.69	5.27
3	18-May	130.0	16.99	13.97	15.57	20.74	29.09
4	19-May	11.0	-	3.74	5.80	5.30	8.26
5	06-Jun	35.8	4.01	2.27	3.14	4.53	2.12
6	17-Jun	43.4	3.43	5.11	6.58	6.49	9.27
7	18-Jun	104.8	8.09	8.68	8.86	16.21	22.36
8	08-Jul	15.2	3.83	2.29	3.49	3.28	4.57
9	21-Jul	17.6	3.57	3.97	3.82	3.64	6.69
10	31-Jul	62.4	2.6	4.22	5.41	9.46	14.11
11	02-Aug	12.6	0.57	1.11	1.79	4.04	2.26
12	03-Aug	42.4	2.23	3.49	4.79	6.34	5.48
13	05-Aug	13.8	1.28	2.66	3.45	3.9	7.4
14	26-Aug	20.2	1.82	2.99	3.45	3.87	6.41
15	27-Aug	25.4	4.47	2.89	3.35	8.28	11.33
16	30-Aug	56.4	4.75	4.92	4.89	4.78	7.11
17	01-Sep	8.2	0.46	1.28	1.57	2.56	3.77
18	04-Sep	18.6	2.62	2.72	2.42	6.86	10.08
19	05-Sep	69.8	3.45	3.66	6.58	6.42	13.02
20	01-Oct	26.4	2.13	1.63	0.8	1.34	4.13
21	02-Oct	6.0	0.67	0.58	0.66	0.82	1.66
22	08-Oct	21.2	2.17	3.68	5.15	3.4	6.61
23	11-Oct	71.2	8.6	12.07	13.24	11.65	17.29
24	14-Oct	60.0	10.77	12.87	11.03	16.94	20.4
25	15-Oct	56.2	5.91	6.49	7.46	10.68	13.19
26	16-Oct	9.0	0.64	0.29	1.29	1.44	2.22
27	17-Oct	44.0	1.75	4.87	4.37	8.49	10.44
28	19-Oct	22.2	0.86	2.64	1.49	3.46	7.16
29	20-Oct	20.0	0.45	1.84	1.22	1.9	5.47
30	30-Oct	12.4	0.4	1.64	1.93	3.87	5.79
31	03-Nov	7.0	0.24	1.02	1.1	1.49	4.99
32	13-Nov	6.4	0.19	0.42	0.39	0.64	0.84
33	24-Nov	9.4	0.28	0.47	0.53	0.28	0.76
34	11-Dec	59.4	7.25	7.68	9.06	10.92	12.69

T₁: Pomelo (Orchard crop)
T₂: Castor

T₃: Pigeon pea
T₄: Chickpea

T₅: Control (No crop)

Table 2: Rainwater directly fall on farm pond (mm) during the cropping period, 2022

Comment [S.30]: Suggested to present this result into a graph

Sl. No.	Date	Rainfall (mm)	Rainwater directly fall on Farm pond (m ³)	
			Cross sectional area of Farm pond (P ₁) under T ₁ (81 m ²)	Cross sectional area of Farm ponds (P ₂ , P ₃ , P ₄ & P ₅) under T ₂ , T ₃ , T ₄ & T ₅ (110.25 m ²)
1	15-May	14.0	0.11	0.15
2	17-May	16.4	0.13	0.18
3	18-May	130.0	1.05	1.43
4	19-May	11.0	0.09	0.12
5	06-Jun	35.8	0.29	0.4
6	17-Jun	43.4	0.35	0.48
7	18-Jun	104.8	0.85	1.16
8	08-Jul	15.2	0.12	0.17
9	21-Jul	17.6	0.14	0.19
10	31-Jul	62.4	0.51	0.69
11	02-Aug	12.6	0.1	0.14
12	03-Aug	42.4	0.34	0.47
13	05-Aug	13.8	0.11	0.15
14	26-Aug	20.2	0.16	0.22
15	27-Aug	25.4	0.21	0.28
16	30-Aug	56.4	0.46	0.62
17	01-Sep	8.2	0.07	0.09
18	04-Sep	18.6	0.15	0.21
19	05-Sep	69.8	0.57	0.77
20	01-Oct	26.4	0.21	0.29
21	02-Oct	6.0	0.05	0.07
22	08-Oct	21.2	0.17	0.23
23	11-Oct	71.2	0.58	0.79
24	14-Oct	60.0	0.49	0.66
25	15-Oct	56.2	0.46	0.62
26	16-Oct	9.0	0.07	0.1
27	17-Oct	44.0	0.36	0.49
28	19-Oct	22.2	0.18	0.25
29	20-Oct	20.0	0.16	0.22
30	30-Oct	12.4	0.1	0.14
31	03-Nov	7.0	0.06	0.08
32	13-Nov	6.4	0.05	0.07
33	24-Nov	9.4	0.08	0.1
34	11-Dec	59.4	0.48	0.66
Total			9.31	12.69

Table 3: Actual runoff (mm) in different treatments during a cropping period, 2022

Comment [S.31]: Suggested to present this result into a graph

Sl. No.	Date	Rainfall (mm)	Actual runoff (mm)				
			T ₁	T ₂	T ₃	T ₄	T ₅
1	15-May	14.0	0.25	0.27	0.62	1.07	1.78
2	17-May	16.4	0.41	2.84	2.56	3.39	4.93
3	18-May	130.0	13.72	11.24	13.0	18.35	26.39
4	19-May	11.0	-	3.51	5.58	5.1	8.03
5	06-Jun	35.8	3.11	1.52	2.44	3.87	1.37
6	17-Jun	43.4	2.34	4.2	5.73	5.69	8.37
7	18-Jun	104.8	5.46	6.48	6.79	14.28	20.18
8	08-Jul	15.2	3.45	1.97	3.19	3	4.25
9	21-Jul	17.6	3.13	3.6	3.47	3.32	6.33
10	31-Jul	62.4	1.04	2.91	4.18	8.32	12.81
11	02-Aug	12.6	0.26	0.85	1.55	3.8	1.99
12	03-Aug	42.4	1.17	2.61	3.95	5.56	4.6
13	05-Aug	13.8	0.94	2.38	3.18	3.65	7.12
14	26-Aug	20.2	1.31	2.57	3.05	3.49	5.98
15	27-Aug	25.4	3.83	2.35	2.85	7.81	10.8
16	30-Aug	56.4	3.34	3.74	3.78	3.74	5.94
17	01-Sep	8.2	0.25	1.1	1.4	2.41	3.6
18	04-Sep	18.6	2.15	2.33	2.06	6.52	9.69
19	05-Sep	69.8	1.7	2.2	5.2	5.14	11.57
20	01-Oct	26.4	1.47	1.08	0.28	0.86	3.58
21	02-Oct	6.0	0.52	0.46	0.55	0.71	1.53
22	08-Oct	21.2	1.64	3.24	4.73	3.01	6.17
23	11-Oct	71.2	6.81	10.57	11.83	10.34	15.81
24	14-Oct	60.0	9.26	11.62	9.85	15.84	19.15
25	15-Oct	56.2	4.5	5.31	6.35	9.64	12.02
26	16-Oct	9.0	0.41	0.1	1.11	1.27	2.03
27	17-Oct	44.0	0.64	3.95	3.5	7.68	9.52
28	19-Oct	22.2	0.3	2.18	1.05	3.05	6.7
29	20-Oct	20.0	-	1.42	0.83	1.53	5.06
30	30-Oct	12.4	0.09	1.38	1.69	3.64	5.54
31	03-Nov	7.0	0.06	0.87	0.96	1.36	4.85
32	13-Nov	6.4	0.03	0.28	0.27	0.53	0.71
33	24-Nov	9.4	0.04	0.27	0.35	0.11	0.56
34	11-Dec	59.4	5.76	6.44	7.88	9.83	10.81
Total			79.39	107.84	125.81	177.91	259.77

3.4 Runoff as influenced by rainfall characteristics under different treatments.

In the experimental plots, the highest recorded rainfall of 130 mm with an intensity of 80 mm/hr resulted in the highest runoff: 13.72 mm in T₁, 11.24 mm in T₂, 13.00 mm in T₃, 18.35 mm in T₄, and 26.39 mm in T₅. Another significant rainfall event of 104.8 mm, also with 80 mm/hr intensity, led to runoff of 5.46 mm in T₁, 6.48 mm in T₂, 6.79 mm in T₃, 14.28 mm in T₄, and 20.18 mm in T₅ (Table-4).

Table 4: Runoff as influenced by rainfall intensity under different treatments

Comment [S.32]: Suggested to present this result into a graph

Sl. No.	Rainfall (mm)	Max. RF Intensity (mm/h)	Runoff (mm)				
			T ₁	T ₂	T ₃	T ₄	T ₅
1	14.0	4.0	0.25	0.27	0.62	1.07	1.78
2	16.4	26.0	0.41	2.84	2.56	3.39	4.93
3	130.0	80.0	13.72	11.24	13.0	18.35	26.39
4	11.0	16.0	-	3.51	5.58	5.1	8.03
5	35.8	80.0	3.11	1.52	2.44	3.87	1.37
6	43.4	*	2.34	4.2	5.73	5.69	8.37
7	104.8	80.0	5.46	6.48	6.79	14.28	20.18
8	15.2	26.0	3.45	1.97	3.19	3	4.25
9	17.6	*	3.13	3.6	3.47	3.32	6.33
10	62.4	80.0	1.04	2.91	4.18	8.32	12.81
11	12.6	28.0	0.26	0.85	1.55	3.8	1.99
12	42.4	36.0	1.17	2.61	3.95	5.56	4.6
13	13.8	32.0	0.94	2.38	3.18	3.65	7.12
14	20.2	22.0	1.31	2.57	3.05	3.49	5.98
15	25.4	36.0	3.83	2.35	2.85	7.81	10.8
16	56.4	40.0	3.34	3.74	3.78	3.74	5.94
17	8.2	28.0	0.25	1.1	1.4	2.41	3.6
18	18.6	18.0	2.15	2.33	2.06	6.52	9.69
19	69.8	*	1.7	2.2	5.2	5.14	11.57
20	26.4	24.0	1.47	1.08	0.28	0.86	3.58
21	6.0	8.0	0.52	0.46	0.55	0.71	1.53
22	21.2	28.0	1.64	3.24	4.73	3.01	6.17
23	71.2	40.0	6.81	10.57	11.83	10.34	15.81
24	60.0	48.0	9.26	11.62	9.85	15.84	19.15
25	56.2	34.0	4.5	5.31	6.35	9.64	12.02
26	9.0	32.0	0.41	0.1	1.11	1.27	2.03
27	44.0	48.0	0.64	3.95	3.5	7.68	9.52
28	22.2	40.0	0.3	2.18	1.05	3.05	6.7
29	20.0	24.0	-	1.42	0.83	1.53	5.06
30	12.4	10.0	0.09	1.38	1.69	3.64	5.54
31	7.0	6.0	0.06	0.87	0.96	1.36	4.85
32	6.4	8.0	0.03	0.28	0.27	0.53	0.71
33	9.4	14.0	0.04	0.27	0.35	0.11	0.56
34	59.4	*	5.76	6.44	7.88	9.83	10.81

The smallest rainfall of 6 mm, with an intensity of 8 mm/hr, resulted in minimal runoff: 0.52 mm in T₁, 0.46 mm in T₂, 0.55 mm in T₃, 0.71 mm in T₄, and 1.53 mm in T₅. Throughout the entire cropping period the highest rainfall recorded was 130.0 mm followed by 104.8 mm with the highest rainfall intensity of 80 mm/hr. The highest rainfall intensity resulted in higher runoff contribution from the treatments.

3.5 Stages of crop growth as influenced by runoff

Crop growth is affected by climatic factors, especially rainfall patterns in rainfed agriculture. Table 5 and Figure 2 illustrate runoff variations among treatments during the cropping period. November had the least runoff, with Pomelo (T₁) having 0.13 mm, followed by Castor (T₂), Pigeon pea (T₃), Chickpea (T₄), and Control (T₅). Canopy size differences explain runoff variances, consistent with Kang *et al.* (1982).

The study indicated that the percentage of runoff to monthly rainfall in different treatments stated that the Control (T₅) plot had the highest runoff percentage in October (24.13%), while Pomelo (T₁) had the lowest in November (0.43%). The runoff trend followed Pomelo < Castor < Pigeon pea < Chickpea < Control (Table 5 & Figure 3). The results of the study confirmed with Ground vegetation retards water flow and extends soil seepage time, consistent conducted by Sharma *et al.* (2000).

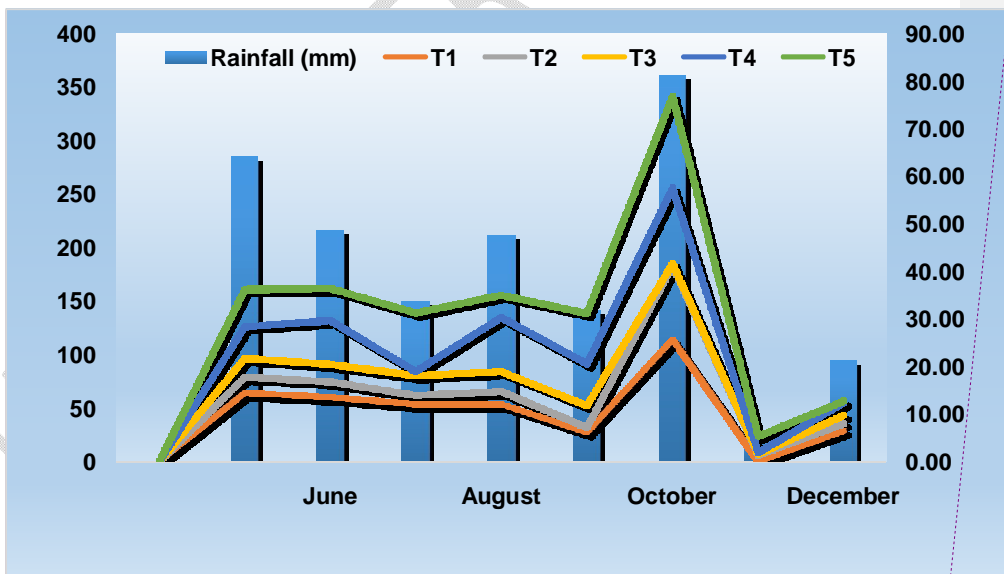
In the plots, Control (T₅) had the highest runoff of 259.77 mm due to lack of canopy cover, while Pomelo (T₁) had the lowest runoff of 79.39 mm, correlating with its substantial canopy cover (11.66 m²/tree). Castor (T₂) had runoff of 107.84 mm with 0.37 m²/plant canopy cover, Pigeon pea (T₃) had 125.81 mm runoff with 0.34 m²/plant canopy cover, and Chickpea (T₄) had 177.91 mm runoff with the least canopy coverage (0.01 m²/plant). Table 5 details crop canopy cover and runoff.

Table 5: Effect of runoff (mm) in different treatments during the cropping period of 2022

Month	Rainfall (mm)	Runoff (mm)				
		T ₁ Pomelo	T ₂ Castor	T ₃ Pigeon pea	T ₄ Chick pea	T ₅ Control
May	285.2	14.38 (5.04)	17.86 (6.26)	21.76 (7.63)	27.91 (9.79)	41.13 (14.42)
Jun	216.8	10.91 (5.03)	12.20 (5.63)	14.96 (6.90)	23.84 (11.00)	29.92 (13.80)
Jul	149.8	7.62 (5.09)	8.48 (5.66)	10.84 (7.24)	14.64 (9.77)	23.39 (15.61)
Aug	211.4	10.85 (5.13)	14.50 (6.86)	18.36 (8.68)	28.05 (13.27)	36.43 (17.23)
Sep	141.8	4.10 (2.89)	5.63 (3.97)	8.66 (6.11)	14.07 (9.92)	24.86 (17.53)
Oct	361	25.64 (7.10)	41.31 (11.44)	41.77 (11.57)	57.57 (15.95)	87.11 (24.13)
Nov	30	0.13 (0.43)	1.42 (4.73)	1.58 (5.26)	2.00 (6.66)	6.12 (20.40)
Dec	94.6	5.76 (6.09)	6.44 (6.81)	7.88 (8.33)	9.83 (10.39)	10.81 (11.43)
Total	1490.6	79.39 (5.33)	107.84 (7.23)	125.81 (8.44)	177.91 (11.94)	259.77 (17.43)

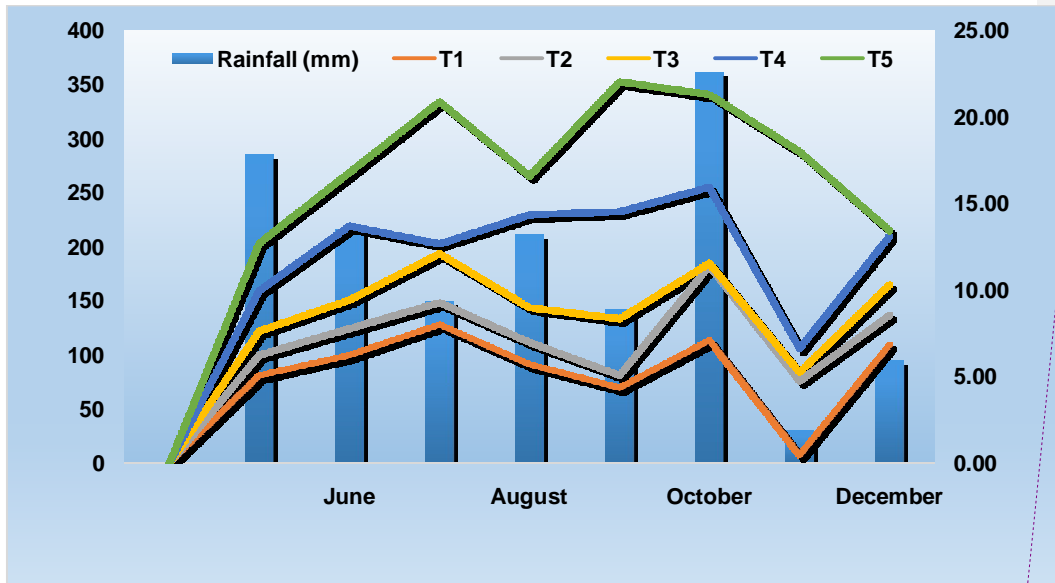
Note: Figures in parenthesis indicate percent of runoff

Comment [S.33]: The data in bracket () represent what kind of data?



Comment [S.34]: Please provide the axis name for x and y axis.

Fig. 2: Effect of runoff (mm) in different treatments during the cropping period of 2022



Comment [S.35]: Please provide the axis name for x and y axis.

Fig. 3: Effect of per cent runoff in different treatments during the cropping period

In the experimental plots, the highest runoff of 259.77 mm was observed in (T_5) Control plot with no crop canopy cover, and the decrease in runoff observed in Pomelo (T_1) with only 79.39 mm runoff with highest crop canopy cover of 11.66 m²/ tree, followed by Castor (T_2) 107.84 mm with canopy coverage of 0.37 m²/ plant, followed by Pigeon pea (T_3) with 125.81 mm of runoff with a average canopy cover 0.34 m²/ plant and finally the Chickpea (T_4) has a runoff of 177.91 mm with least canopy coverage of 0.01 m²/ plant. The data on crop canopy cover and runoff is presented in Table 6.

The crop canopy coverage in between the treatments has a significant change which resulted in higher canopy cover crop has a less runoff when compared to least canopy cover crop this decrease in runoff is due to the presence of dense vegetation, which slows down the speed of runoff, providing more opportunity time for rainwater to infiltrate into the soil. The crop canopy cover area trend is in the order of Control (T_5) < Chickpea (T_4) < Pigeon pea (T_3) < Castor (T_2) and < Pomelo (T_1). The results of the study are on par with the result of the study conducted by Vasquez mendez. *Ret al.* (2010)

Table 6: Runoff (mm) as influenced by crop canopy area (m²) in different treatments during the cropping period of 2022

Cropping Period	T ₁ Pomelo		T ₂ Castor		T ₃ Pigeon pea		T ₄ Chick pea		T ₅ Control		S.Em. ±	CD @ 5%
	Crop Canopy Area (m ²) / tree	Runoff (mm)	Crop Canopy Area (m ²) / tree	Runoff (mm)	Crop Canopy Area (m ²) / tree	Runoff (mm)	Crop Canopy Area (m ²) / tree	Runoff (mm)	Crop Canopy Area (m ²) / tree	Runoff (mm)		
May	11.37	14.38	0.10	17.86	0.05	21.76	*	27.91	-	41.13	0.14	0.41
June	11.56	10.91	0.10	12.20	0.07	14.96	*	23.84	-	29.92	0.13	0.37
July	11.66	7.62	0.16	8.48	0.15	10.84	*	14.64	-	23.39	0.12	0.35
August	11.69	10.85	0.27	14.50	0.26	18.36	*	28.05	-	36.43	0.12	0.35
September	11.71	4.10	0.43	5.63	0.40	8.66	0.00007	14.07	-	24.86	0.12	0.34
October	11.73	25.64	0.52	41.31	0.49	41.77	0.01	57.57	-	87.11	0.13	0.37
November	11.76	0.13	0.66	1.42	0.65	1.58	0.02	2.00	-	6.12	0.12	0.35
December	11.77	5.76	0.69	6.44	0.68	7.88	0.02	9.83	-	10.81	0.12	0.35
Total	11.66	79.39	0.37	107.84	0.34	125.81	0.01	177.91	-	259.77		

Comment [S.36]: Please provide Topic 4.0- CONCLUSION and the end of the result and discussion

*Chick pea crop was sown on 12.09.2022

T₁: Pomelo (Orchard crop)

T₃: Pigeon pea

T₅: Control (No crop)

S.Em: Standard error of mean

T₂: Castor

T₄: Chickpea

CD: Critical difference

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Comment [S.37]: Need to have more citation and references..normally min 20 references