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IRRIGAÇÃO DE ABACAXI ‘BRS IMPERIAL’, POR MICROASPERSÃO, EM SOLO COBERTO COM ‘MULCH’ PLÁSTICO

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1 RESUMO

Os sistemas de irrigação mais recomendados para o abacaxizeiro são os sistemas de irrigação por aspersão convencional ou por irrigação localizada (gotejamento e a microaspersão). A busca por maior eficiência de água pelas culturas indica sistemas de baixas taxas de aplicação de água como o gotejamento e a microaspersão. Atualmente, o uso de cobertura plástica em cultivos de abacaxi com uso do gotejamento tem sido usado pelos agricultores; não se usa a microaspersão com o solo com cobertura plástica devido à falta de estudos para avaliar as perdas e a viabilidade da microaspersão nessa condição. Esse estudo avalia a viabilidade do uso da microaspersão na cultura do abacaxizeiro cultivado com cobertura do solo considerando a sua resposta a irrigação e as perdas de água. Um experimento foi instalado nas condições climáticas do recôncavo da Bahia com a cultivar BRS Imperial plantada em canteiros, com um delineamento experimental em blocos casualizados em esquema de parcelas subdividas 2 x 5, com solo nu e coberto com plástico (mulch), com cinco lâminas de irrigação definidas em função de variações da depleção de água abaixo da capacidade de campo. A precipitação que ocorreu no período experimental foi de 1.404 mm, sendo as demais lâminas aplicadas de 1.800, 1.931, 2.041 e 2.056 mm. As perdas por evaporação e escoamento superficial sobre o plástico equivaleram a 16% da lâmina aplicada; o uso da microaspersão no abacaxizeiro com cobertura plástica apresenta produtividades competitivas, sendo viável nas condições do Recôncavo da Bahia.

Palavras-chave: *Ananas Comosus* (L.), cobertura do solo, lâmina de irrigação.

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MICRO-SPRINKLER IRRIGATION OF 'BRS IMPERIAL' PINEAPPLES IN SOIL COVERED WITH PLASTIC MULCH

2 ABSTRACT

The most recommended irrigation systems for pineapples are conventional sprinkler irrigation or localized irrigation (drip and microsprinkler). The search for greater water efficiency in crops requires low-rate water application systems such as drip and microsprinkler systems. Currently, farmers are using plastic mulch for pineapple crops with drip irrigation. Because of a lack of studies evaluating losses and the viability of microsprinkler irrigation under these conditions, microsprinkler irrigation is not used with soil covered with plastic mulch. In this study, the viability of microsprinkler irrigation in pineapple crops grown with soil mulch was evaluated, considering its response to irrigation and water loss. An experiment was conducted under the climatic conditions of the Recôncavo region of Bahia, using the BRS Imperial cultivar planted in beds. This experiment followed a randomized block design in a 2 x 5 split-plot arrangement. The soil was bare and covered with plastic mulch, with five irrigation depths defined on the basis of variations in water depletion below field capacity. The precipitation during the experimental period was 1,404 mm, with the remaining applied depths being 1,800, 1,931, 2,041, and 2,056 mm. Evaporation and runoff losses over the plastic cover were equivalent to 16% of the applied depth; microsprinkling on pineapple plants with plastic mulch yields competitive yields, making them viable under the conditions of the Recôncavo region of Bahia.

Keywords: *Ananas Comosus* (L.), soil cover, irrigation depth.

3 INTRODUCTION

The proper use of irrigation in pineapple cultivation reduces the crop cycle, increases productivity, and often also improves fruit quality (Almeida *et al.*, 2022). Throughout its cycle, a crop has a constant and variable water demand, depending on its stage of development. During critical phases, especially at the end of the vegetative phase and during flowering, water deficit can affect the weight and quality of the fruits and, consequently, the crop yield (Souza *et al.*, 2009). Irrigation is necessary in situations where there is a period during the year with monthly rainfall of less than 15 mm for three consecutive months, less than 25 mm for four consecutive months, or less than 40 mm for five consecutive months (Almeida; Souza, 2011).

The association of plastic ground cover with irrigation has contributed positively to the success of pineapple production. This cover helps control weeds, prevents excessive heating of the soil, reduces water loss to the atmosphere, increases fertilization efficiency, and minimizes the risk of root and plant injury due to weeding, resulting in a positive impact on crop productivity (Chen *et al.*, 2018; Coelho *et al.*, 2022).

The main irrigation systems used in pineapple cultivation are drip irrigation and microsprinkler irrigation. Drip irrigation is suitable for conditions of limited water availability and high labor costs. The use of plastic as a soil cover in pineapple cultivation under drip irrigation not only increases water use efficiency but also reduces weeding activities and herbicide use. Lima *et al.* (2025) reported that the use of plastic mulch resulted in significant water savings in the cultivation of pineapple cv. BRS Imperial, which was irrigated by drip irrigation. The authors observed a reduction in evapotranspiration and total water depth applied in the evaluated treatments and an increase in the efficient use of water by the crop. The microsprinkler irrigation system adapts well to pineapple because of the shape and distribution of its leaves, which facilitate water uptake and water absorption through the upper adventitious roots (Almeida; Souza, 2011).

Plastic mulch has not been used in sprinkler or microsprinkler-irrigated pineapple cultivation because it prevents water infiltration into the soil and promotes surface runoff, reducing plant water use efficiency. On the other hand, pineapple plants have a known low water demand, as evidenced by their low crop coefficient (Allen *et al.*, 1998; Lima *et al.*, 2025). This low demand, resulting from low daytime transpiration—a characteristic of CAM plants that fix CO2 $_{\text{via}}$ the crassulacean acid metabolism mechanism (Carr, 2012)—indicates a low irrigation requirement for the crop.

Pineapple plant growth, in terms of the number of leaves and leaf area, intensifies after 90 days of planting (Lima *et al.*, 2025), promoting canopy closure. This characteristic, combined with the efficiency of water collection from sprinkler irrigation by the leaves, can result in high water retention in the canopy, which is conducted to the plant stem. Consequently, the fraction of precipitation that effectively reaches the soil significantly decreases, especially when low-intensity irrigation, such as microsprinkling, where the application rate is less than 5 mm h^{-1}, is used.

Water losses due to evaporation during microsprinkler irrigation of pineapple plants grown in raised beds with plastic mulch, as well as losses due to surface runoff in the raised bed, need to be evaluated considering the relatively shallow irrigation depth for pineapple, the high water retention due to the dense foliage of the plants, and the low water application rates of the microsprinkler system. These points suggest the possibility of using plastic soil mulch, with microsprinkler irrigation being viable.

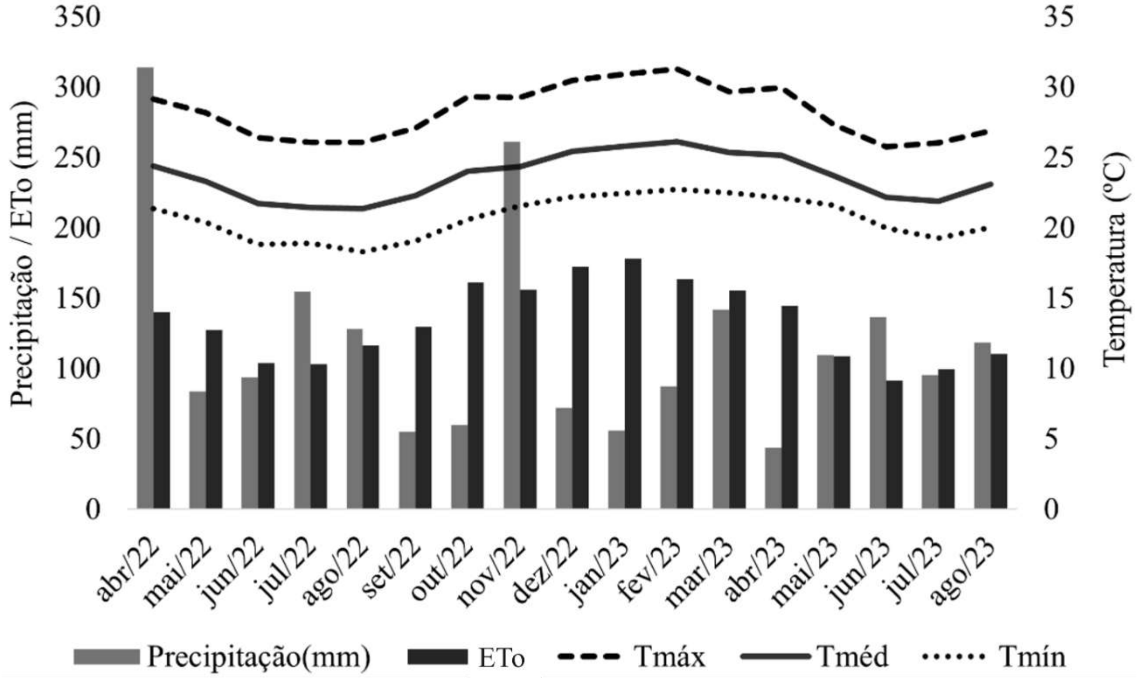
The objectives of this study were to determine the response of the 'BRS Imperial' pineapple to water depth under microsprinkler irrigation, cultivated with and without plastic soil mulching; to evaluate losses due to surface runoff and evaporation in soil covered with plastic mulching and irrigated by microsprinkler irrigation, under the conditions of the coastal plains of Bahia; and to define the viability of using microsprinkler irrigation associated with pineapple cultivation with plastic mulching.

4. MATERIALS AND METHODS

4.1 Description of the experimental area

The experiments were conducted at the Embrapa Cassava and Fruit Crops Experimental Field, located in the municipality of Cruz das Almas – BA, with geographic coordinates 12°40'19” S and 39°06'22” W and an altitude of 225 meters. The municipality is located in the coastal plateau region of the Recôncavo Baiano. The climate is classified as Aw and Am, hot and humid tropical, according to the Köppen classification, with an average annual rainfall of 1,224 mm and a higher incidence of rain between April and July. The average relative humidity is 80%, and the average annual temperature is 24.5 °C (Silva *et al.*, 2016). The precipitation, evapotranspiration, maximum, average, and minimum temperature data during the experimental period are shown in Figure 1.

Figure 1. Maximum temperature (Tmax), minimum temperature (Tmin), average temperature (Tmed), and precipitation and evapotranspiration (ETo) during the growth and production period of pineapple plants in Cruz das Almas, Bahia.



Source: Author (2024).

The soil in the experimental area is classified as yellow latosol or yellow clayey soil with a sandy-clay-loam texture (Table 1).

Table 1 Physical and hydrological attributes of the soil in the experimental area of Embrapa Cassava and Fruit Crops in the 0–0.30 m depth layer.

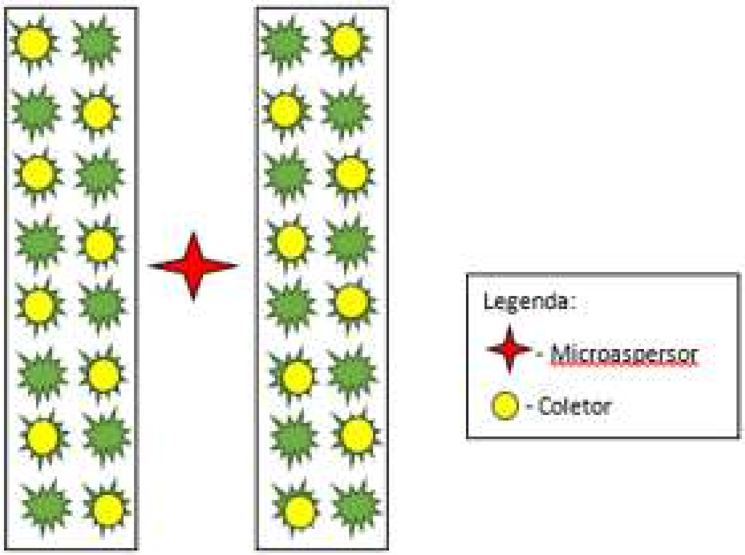
Particle size distribution ------------------(g kg $^{-1}$) ------------------			**Porosity -------------(%)-------------**			**Soil Density (kg dm $^{-3}$)**
Total sand	Silt	Clay	Macro	Micro	Total	
733	94	173	11.98	19.12	31.10	1.55
Soil tension and moisture						**Water Available**
Stress (MPa)	0.01	0.033	0.100	0.300	1,500	
Humidity (cm ^{3} cm $^{-3}$)	0.164	0.143	0.135	0.124	0.113	0.051

Dens. Solo – soil density; Umid - soil moisture. **Source**: Author (2024).

4.2 Characterization of the experiment

Soil preparation consisted of constructing raised beds 0.80 m wide and spaced 1.00 m apart. These were manually covered with double-sided polyethylene film (plastic cover), the sides of which were fixed with soil. The planting of 874 pineapple seedlings cv. BRS Imperial was carried out on April 18, 2022, using a double spacing of 1.00 × 0.40 × 0.40 m, resulting in a density of 35,700 plants per hectare. The experimental plots had dimensions of 6.0 m × 1.5 m and contained 16 plants each, of which the 12 central plants were considered useful for the evaluations (Figure 2).

Figure 2. Arrangement of plants in the experimental plot.



Source: Author (2025).

Irrigation was carried out by a microsprinkler with 70 L h^{-1} emitters and a wetting radius of 2.5 m. Rainfall intensity was determined periodically by evaluating the uniformity of the water distribution and determining the average water depth of the plot. The application intensity (mm h^{-1}) was determined by the ratio between the average water depth applied to the plot (mm) and the irrigation time (h). The water depths were identical for both treatment conditions, with and without plastic cover, until 240 days after planting because sufficient rainfall was needed to eliminate the need for irrigation during that period. In the following months, until harvest, including the flowering and fruit filling stages, there was a greater number of supplementary irrigation events.

randomized block design, with ten treatments and three replications in split plots, with the condition being with or without plastic soil cover placed in the plot (Figure 3) and the irrigation depth corresponding to five water levels equivalent to the replacements of five fractions of the difference between the soil field capacity and the current moisture, when the latter was less than the field capacity moisture.

Figure 3. View of the experiment with water sheets and plastic soil cover in the cultivation of pineapple cv. BRS Imperial.

Source: Author (2023).

The irrigation depths were calculated on the basis of soil moisture monitoring, which was performed using TDR (time domain reflectometry) probes installed 0.10 m from the plants in all the treatments and blocks. Readings were taken three times a week, preceding the irrigation events. The decision to apply the depth was based on a comparison between the current average soil moisture and the moisture corresponding to field capacity. The difference between the field capacity and current moisture differed with respect to the irrigation depth (f) (L1: 0.0; L2: 0.35; L3: 0.55; L4: 0.75 and L5: 1.00) (Equation 1).

$$L = ((\theta_{CC} - \theta_{Atual}) * f * Z * 10 \qquad (1)$$

where L is the irrigation depth of the treatment (mm); θ_{CC} is the volumetric moisture at field capacity (cm ^{3} cm $^{-3}$); f is the fraction of field capacity of the soil; θ_{Actual} is the current volumetric moisture (cm ^{3} cm $^{-3}$); and z is the root system depth (cm).

The irrigation time was calculated according to Bernardo, Soares and Mantovani (2006) (Equation 2).

$$Ti = \frac{L}{I_a} \qquad (2)$$

where : Ti – Irrigation time (hours); I_a – Water application intensity of the system (mm h $^{-1}$); and L – total water depth to be applied per irrigation (mm).

4.3 Assessments during the crop cycle

Plant growth was evaluated using the following variables: the number of leaves, width and length of the 'D' leaf, physiologically active leaf, and the longest and most fully expanded leaf of the pineapple plant. Evaluations were performed at different frequencies according to the season. During the rainy season, in the absence of irrigation, determinations were made monthly, from July 19th to November 17th, 2022. During the dry season, under irrigation, two evaluations were carried out: on December 14th, 2022, and on February 23rd, 2023, the latter five days after floral induction. The evaluations characterizing the irrigations consisted of measurements of the applied irrigation depth (calculated gross depth), evaporation during irrigation, and surface runoff of water in the beds covered with plastic. Evaporation during irrigation was measured in four trays with 600 ml of water, which were placed next to the experiment, after which the volume in each tray before and after irrigation was determined. The evaporation for each irrigation depth applied, in millimeters, was obtained as the difference between the initial volume (v _i) of water in the tray at the beginning of irrigation and the final volume (v_f) after irrigation, in liters of water, divided by the area of the tray in square meters. After irrigation, a tray containing 300 ml of water was placed over the plot with plastic covering. This was removed after the covering dried, and the evaporated volume was recorded, which, divided by the area of the tray, resulted in the evaporation depth (E_{vf}). The total evaporation in the plot corresponding to the applied depth was obtained by summing the evaporation depth of the trays before (E_{vi}) and after irrigation (E_{vf}), in the case of covered soil. In bare soil, evaporation was considered only during irrigation (E_{vi}).

Surface runoff water was collected from the plastic-covered garden beds using 3 m long PVC gutters installed on each side of the bed (Figure 4), maintaining a 0.3% slope along the length. Rectangular plastic bottles were installed at the end of the gutters to collect all the water that ran off the surface of the plots. The volume contained in the bottles was measured using a graduated cylinder on both sides of the bed. Data were collected on four dates: November 18, 2022; November 23, 2022; February 6, 2023; and February 17, 2023.

Figure 4. Plot with gutters for collecting surface water runoff in the flowerbeds with plastic covering.

Source: Author (2023).

The total volume (Vt) drained per plot corresponded to the sum of the volumes (V) collected on both sides of the plot (Equation 3).

$$V_t = V_{do\ lado\ direito} + V_{do\ lado\ esquerdo} \quad (3)$$

After the total runoff was obtained, the value obtained was divided by the area of the plot (6 m × 1.05 m = 6.3 m$^{2)}$ to obtain the surface runoff with respect to water depth (mm) (Equation 4).

$$R = \frac{Vt}{A} \quad (4)$$

where R is the total surface runoff per plot (mm), Vt is the total runoff (L), and A is the area of the plot (m$^{2)}$.

The liquid depth applied to the plants (LI_n) was determined using Equation 5 on the same dates as the collection of the flask volumes mentioned above.

$$\mathrm{LIn} = \mathrm{I} - (\mathrm{R} + \mathrm{L_e}) \quad (5)$$

where LI $_n$ is the total net water depth used by plants in the experimental plot (mm); I is the water depth applied by irrigation (mm); R is the water depth runoff from the covered surface of the plot per plot (mm); and L $_{and}$ is the evaporated water content from the covered surface of the plot during irrigation and after irrigation on the covered soil surface (mm).

The averages of the observations of losses due to evaporation (Evi) and surface runoff (R) obtained on the four dates were summed to determine the fractions of the total applied water depth related to evaporation and surface runoff under irrigation.

At harvest, the weight, circumference, and length of the fruit, the length of its crown, and the number of seedlings (offshoots) per plant were evaluated. Agronomic water productivity was determined by the ratio between fruit productivity and the total net irrigation depth calculated for soil water replenishment plus the total rainfall during the period (Equation 6):

$$P_a = \frac{P_c}{I+P} \quad (6)$$

where P $_a$ is the water productivity (kg mm $^{-1}$ ha $^{-1}$), Pc is the productivity of marketable fruits (kg ha $^{-1}$), I is the irrigation water depth (mm), and P is the precipitation (mm).

Considering the similarity of the irrigation depths applied under conditions with and without soil cover, the average of the irrigation depths applied under both covered and uncovered soil conditions was used for growth and yield analyses. In the water productivity analysis, the calculated irrigation depth was considered; therefore, it was necessary to consider both soil cover conditions. In the case of the condition without cover, the irrigation depth considered was the depth (rainfall or irrigation) without the fraction of water evaporation from the soil during irrigation (Evf). In the condition with cover, the irrigation depth corresponded to LIn from Equation 5, that is, the applied depth, discounting evaporation during irrigation and over the plastic cover, in addition to surface runoff.

Plant growth and productivity were analyzed in a 2 × 5 split-plot design, corresponding to the presence or absence of soil cover and different irrigation depths, respectively. Analysis of variance (ANOVA) was performed using the SISVAR® program (FERREIRA, 2019). Initially, the normality of the residuals for each dependent variable was verified using the Shapiro–Wilk test. To compare the effects of soil cover, the means were subjected to Tukey's test at a 5% probability level. To determine the effect of irrigation depth, regression analysis was applied.

5 RESULTS AND DISCUSSION

5.1 Precipitation and irrigation depths

The experimental period was characterized by regular rainfall, with supplemental irrigation to maintain soil moisture. Harvesting began on July 7, 2023, at 446 days after planting (DAP), for treatments with plastic cover, and on July 17, 2023, at 456 DAP, for those without cover.

As shown in Table 2, the irrigation depths and total water (irrigation + rainfall) were similar between the treatments with and without plastic cover. This behavior is attributed to supplemental irrigation and the regularity of rainfall throughout the study area. The reference evapotranspiration and accumulated rainfall were 1,483 mm and 1,404 mm, respectively.

Table 2. Irrigation depths and totals (irrigation and rainfall) applied in treatments with and without plastic soil cover during the experimental period.

Water application	Ground cover	--------------------- Blades (mm) ---------------------				
		1	2	3	4	5
Irrigation	Without	-	382	544	683	671
	With	-	411	511	593	634
Irrigation + rain	Without	1.404	1,786	1,948	2.087	2.075
	With	1.404	1,815	1,915	1,997	2.038
Average		1.404	1,800	1,931	2.042	2.056

Source: Author (2025).

Table 3 presents the distribution of irrigation water for the 'BRS Imperial' pineapple crop, which was evaluated on four different dates during floral induction and fruit growth. The applied water depths varied between 4.0 and 10.0 mm per hour, whereas the water depths actually collected during the same period ranged from 3.6 to 5.9 mm. Evaporation losses during irrigation (EVi) ranged from 4.8% to 8.4% of the total loss. Surface runoff losses in the beds were more significant in the vegetative phase prior to floral induction, reaching up to 23% of the total losses (EVi + R); these values were obtained without considering evaporation on the plastic sheet after irrigation. Despite the high variability observed in surface runoff and total losses, a value of 16% was adopted as an estimate of the combined losses due to evaporation and surface runoff during irrigation.

Table 3. Average irrigation depth collected (LamC), total irrigation depth applied (LamA), losses due to evaporation (Evi) and surface runoff in the beds (R), and percentages of losses in relation to the total depth (PerdaLamT) in treatments with and without plastic soil cover on four collection dates during the experimental period.

Date	LamC	Evi + R	Mud	LossLamT	Avoid	R
	------------- mm	--------------		----------------- %	---------------	
18/11/2022	3.8	1.3	5.1	25.1	5.8	19.4
	4.1	1.3	5.4	24.9	5.9	23.1
23/11/2022	5.4	1.0	6.4	15.0	6.7	14.7
	6.2	1.1	7.3	14.5	5.9	6.6
01/06/2023	5.9	1.5	7.4	20.7	8.4	9.1
	3.7	0.3	4.0	8.3	4.8	3.4
02/06/2023	8.1	1.9	10.0	19.0	6.4	4.8
	7.1	0.2	7.3	2.5	6.4	1.9
Average	5.5	1.1	6.6	16.4	6.3	10.4
DesvPad	1.6	0.5	1.8	8.6	1	7.8
CV (%)	29	50	27	53	16	75

SDV); Coefficient of Variation (CV). **Source** : Author (2025).

a) Plant growth

The results for the plant growth variables revealed a homoscedastic pattern. Analysis of variance of the variables obtained 311 days after planting (during the floral induction period) revealed an effect only on soil cover, with significant differences between the means of the treatments with and without plastic soil cover considering all water depths (rain + irrigation) applied. The means of the number, length, width, and area of leaves in the treatment with soil cover were greater than those in the treatment without cover (Table 4). The means of the growth variables during the floral induction period obtained for the total water depths applied (rain and irrigation) did not allow the generation of a mathematical model to fit the water depths to these means of the growth variables. The mean length of the leaf 'D' was consistent with that observed by Franco *et al.* (2014), which was 60.1 cm for the 'Pérola' cultivar obtained during the induction period, when a water depth of 2,200 mm was applied in the cycle, although it was smaller than the average length of the same cultivar (Kist *et al.*, 2011).

Table 4. Growth level of pineapple plants of the cultivar BRS Imperial at 311 days after planting, with and without plastic soil cover, in response to different water depths (mm). Cruz das Almas, 2023.

Variables	Ground cover	CV1 and CV2 (%)	Average
Number of sheets	with	1 - 16.1	40.70 a
	without	2 - 13.1	32.30 b
Sheet length D (cm)	with	1 – 11.6	60.40 a
	without	2 - 11.2	56.70 a
Sheet width (cm)	with	1 – 11.3	5.79
	without	2 – 7.6	5.41 b
Leaf area (^{m2})	with	1 - 21.2	1.60 a
	without	2 – 16.1	1.17 b

Means followed by the same letters in the same column do not differ from each other at the 5% probability level.
Source: Author (2025).

The data in Table 5 show the evolution of pineapple plant growth in the phase of the cycle preceding floral induction, a period between 246 and 311 days after planting (DAP), in which the plants exhibit the highest growth rates (Lima *et al.*, 2024). During this period, plant growth was greater in the treatments with plastic soil cover ($p < 0.05$) for the variables studied. The number of leaves produced between 246 and 311 DAP was generally greater than that reported by Franco *et al.* (2014) during the same period for the 'Pérola' cultivar.

Table 5. Plant growth from 246 to 311 days after planting, in response to soil cover treatments, within each water depth studied. Cruz das Almas, BA, 2023.

Variables	**Ground cover**	**CV (%)**	**Blade (mm)** **1.404**	**1.805**	**1,931**	**2.042**	**2.056**
Number of sheets	With	1 - 21.0	20.3 a	12.0 a	10.0 a	8.0 a	19.3 a
	Without	2 - 20.7	6.6 b	1.3 b	9.6 b	2.0 b	9.3 b
Sheet length (cm)	With	1 - 11.6	11.7 a	11.6 a	12.7 a	7.0 a	9.0 a
	Without	2 - 11.2	4.0 b	2.0 b	4.8 b	4.6 b	8.3 b
Sheet width (cm)	With	1 - 11.3	1.0 a	0.3 a	0.53 a	0.5 a	0.6 a
	Without	2 - 7.6	0.4 b	0.3 a	0.3 a	0.4 a	0.5 a
Leaf area (^{m2})	With	1 - 21.2	0.5 a	0.6 a	0.5 a	0.3 a	0.7 a
	Without	2 - 16.1	0.1 b	0.1 b	0.4 a	0.3 a	0.6 a

Values followed by the same letter in the column do not differ from each other according to Tukey's test.
Source: Author (2025).

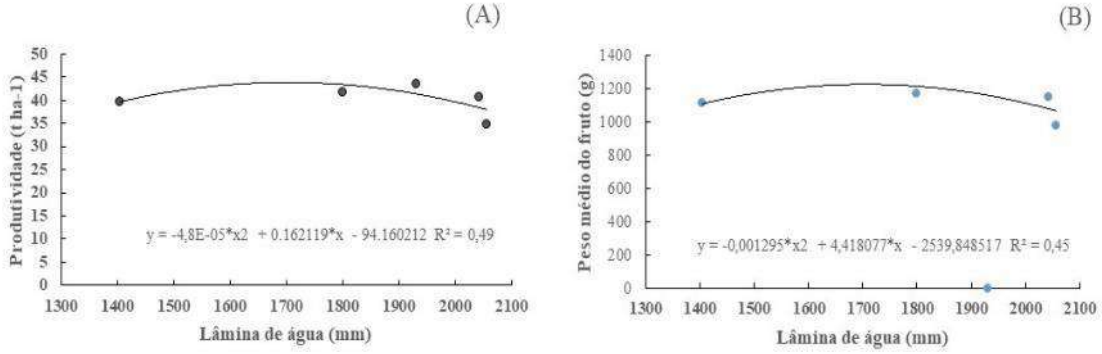
Analysis of variance did not detect an effect of irrigation depth on the growth variables, which was due to rainfall conditions totaling 1,404 mm during the experiment, with 76% of the months from planting to harvest having monthly rainfall exceeding 70 mm throughout the crop cycle (Figure 1). This water depth meets the water needs of pineapple plants (BRASIL, 2012). This rainfall regime conditioned the soil to maintain moisture above or at field capacity, which promoted plant growth.

Increased leaf depth did not result in an increase in the number of leaves produced or in the dimensions of the leaf 'D', and a significant increase in leaf area occurred in the case of treatments without plastic soil cover for depths equal to or above 1,931 mm (Table 5). Plastic soil cover maintains soil moisture levels with less variation over time, according to the applied depth, and contributes to its distribution in the wetted volume of the soil, promoting greater plant growth (Coelho *et al.*, 2022; Coelho *et al.*, 2024).

b) Fruit productivity and water productivity

Analysis of variance revealed an effect of the applied water depth on the average fruit weight and fruit productivity. In this case, both the average fruit weight and the productivity presented a polynomial function of degree 2. The maximum productivity and maximum average weight values were 42.7 t ha^{-1} ^{and} 1,288 kg, respectively. The maximum productivity corresponded to a water depth of 1,688 mm, and the maximum average fruit weight corresponded to a water depth of 1,705 mm (Figure 5). The maximum productivity was lower than that obtained by Lima *et al.* (2025) under drip irrigation, although the average fruit weight was similar in both studies. However, both productivity and average fruit weight were higher than the averages obtained under the conditions of the state of Espírito Santo (Santana *et al.*, 2021) under drip irrigation, with water depths close to or greater than 3,000 mm.

Figure 5. Response of the BRS Imperial pineapple to water, considering total productivity (A) and average fruit weight (B).



Source: Author (2025).

Table 6 shows the averages of the production variables, namely, the average fruit weight, crown length, commercial productivity, number of suckers per plant, and fruit length and diameter, when soil cover conditions and water depths (irrigation + rain) applied are considered. There was no effect of plastic soil cover, except for the number of suckers, whose average was greater for the covered soil condition than for the bare soil condition. The average productivity did not differ for soil conditions with and without plastic cover considering all total water depths applied.

Table 6. Average fruit weight (PMF), fruit diameter (DIAMF), fruit length (COMF), crown length (COMPC), commercial productivity (PRDTCO) and number of suckers per plant (NFILH) of pineapple cv. BRS Imperial in response to plastic soil cover and irrigation levels.

Blade (mm)	Ground cover	PMF (g)	PRDTCO (t ha $^{-1}$)	COMF	DIAMF	COMPC	NFILH
				--------------	cm	--------------	
1.404	with	1.183	42,265	16.1	12.3	19.2	6 a
	without	1.044	37,314	16.7	11.1	18.2	4 a
1,800	with	1.223	43,696	16.1	11.3	18.9	6 a
	without	1.117	34,917	14.6	10.7	18.4	5 a
1,931	with	1.277	45,634	17.0	11.3	18.3	7 a
	without	1,160	41,457	16.4	11.1	18.3	5 a
2.042	with	1.261	45,039	15.8	11.7	19.4	6 a
	without	1.039	36,328	15.2	10.8	18.9	5 a
2.056	with	1.043	37,272	16.3	11.0	19.4	6 a
	without	911	32,566	13.3	10.7	18.4	3 b
Averag e	with	1.198	41,800	16.3	11.5	19.1	6.4 a
	without	1.054	39,294	15.2	10.9	18.4	4.8 b
CV - 1	(%)	8.5	13.5	5.5	7.9	6.2	1.6
CV - 2	(%)	10.3	15.5	7.6	9.5	5.4	16.7

Values followed by the same letter in the column do not differ from each other according to Tukey's test.
Source: Author (2025).

Although statistical analysis revealed an effect of ground cover only on the number of offspring, the averages of all productive variables at all water depth levels were numerically greater in the treatment with plastic cover. This effect was more pronounced for productivity, a synthesis variable that integrates the other production components.

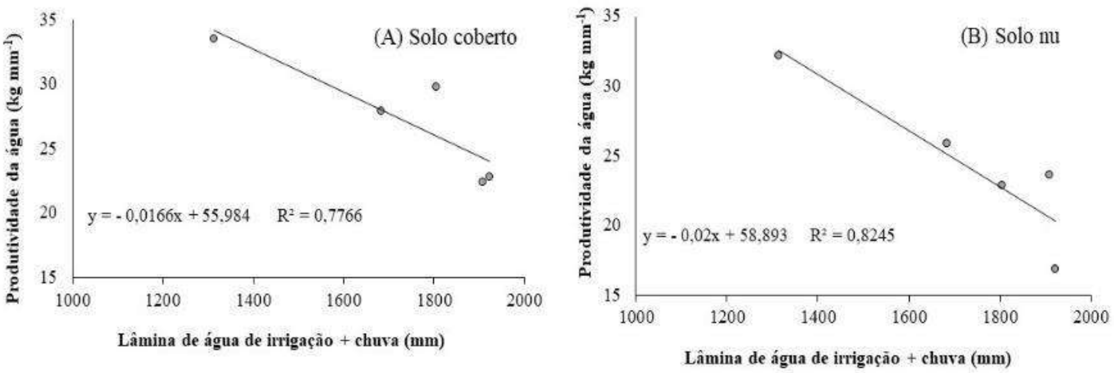
The productivity values obtained in the treatment without cover (bare soil) were higher than those reported by Lima *et al.* (2025) for the same cultivar under drip irrigation and were equivalent to those of the treatment with plastic cover under the conditions of the present study. Additionally, the results for fruit length and diameter, as well as crown length, were consistent with the data reported by the aforementioned authors.

The results demonstrate that the use of plastic ground cover, under subhumid or humid conditions, for pineapple grown in raised beds under microsprinkler irrigation is technically feasible, with a tendency toward higher productivity compared with conditions without ground cover. The growth and production variables were predominantly influenced by rainfall, which contributed, on average, 54% to 72% of the total water applied during the cycle. This rainfall was distributed over 13 of the 16 months (uncovered soil) and 13 of the 15 months (covered soil), thus inhibiting the effects of irrigation and ground cover.

In this study, the applied water depth (irrigation + rain) did not influence production. The lowest water depth was 1,404 mm (rain), which falls within the crop's range of 1,000 to 1,500 mm, with a monthly distribution between 60 and 150 mm (BRASIL, 2012). The difference between the water depths was relatively small. Furthermore, pineapple is a low-water-consuming crop with low crop coefficients (Lima *et al.*, 2024; San-José; Montes; Nikonova, 2007; Allen *et al.*, 1998), which is consistent with the morphophysiological characteristics of the crop and its water relations, with a low transpiration of 0.3 mg to 0.5 mg of water per cm^2 ^{of} leaf area/hour (Schaffer; Andersen, 1994), in addition to its high capacity for water uptake by the leaves and its storage in the leaf hypodermis tissue.

Analysis of variance revealed a significant effect of the applied liquid water depth on the agronomic water productivity (WP) of the 'BRS Imperial' pineapple. The relationship between water depth and WP was linear. The WPs ranged from 17 to 32 kg mm^{-1} ^{in} the bare soil condition (Figure 6B), which were lower than those observed for the soil cover condition, which ranged from 22 to 33 kg mm^{-1} $^{(}$Figure 6A). These results are expected, since there was no significant difference between crop productivity with a lower water depth used by plants in covered soil. Soil cover favors the conservation of the moisture necessary for roots, which are important elements for crop growth and productivity. Under bare soil conditions, soil water evaporation contributes predominantly to losses until the leaves completely cover the plot. Water productivity under bare soil conditions did not differ from the average obtained by Lima *et al*. (2025) under the same conditions and was lower than that obtained by the same authors when a drip irrigation system was used.

Figure 6. Water productivity of pineapple cv. BRS Imperial in soil with (A) and without plastic cover (B) in response to total water depth (irrigation + precipitation). Cruz das Almas, BA, 2023.



Source: Author (2025).

Plastic mulch is a common practice in pineapple cultivation, especially in water-scarce regions, and is generally associated with drip irrigation systems. Although more suitable for raised bed cultivation, its use is not widespread in sprinkler irrigation systems. The results of this study demonstrate the technical viability of plastic mulch under microsprinkler irrigation, indicating a trend toward productivity gains associated with reduced water consumption.

6 CONCLUSIONS

The maximum average productivity (40.7 t ha^{-1}) and average fruit weight (1,288 kg) of the BRS Imperial pineapple variety were between 1,688 and 1,705 mm.

In microsprinkler irrigation, plastic soil cover can cause an average loss of 16%, with a standard deviation of 8.6% of the applied water depth, considering water evaporation during irrigation, evaporation over the plastic after irrigation, and water runoff from the planting bed during irrigation.

The use of microsprinkler irrigation in pineapple cultivation with plastic-covered soil results in competitive yields, even when irrigation water losses due to evaporation and surface runoff are considered, and is viable under the edaphoclimatic conditions of the Recôncavo region of Bahia and similar areas.

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