

Production characteristics of watermelon, under different coverings and irrigation with deficit, using the ISAREG model

ABSTRACT

Even with the growing scenario of water scarcity, in the Northeastern semi-arid region, the irrigation management is still not properly managed, resulting in the waste of scarce water resources in the region. The ISAREG model has been used in several countries, being able to assist in the simulation of irrigation. In addition, the ISAREG model quantifies irrigation depths at different percentages of storage, increasing irrigation efficiency. Another way to reduce the use of water resources in agriculture is through the use of soil cover, which is a simple technology and whose benefits over crop production and productivity are irrefutable. Added to this is the fact that visual interaction can amplify these effects. The objective of this study was to compare the irrigation propositions generated from ISAREG model with the irrigation management adopted by the irrigators of the Jaguaribe - Apodi Irrigation District, evaluating and analyzing the fruit development variables and crop productivity under the different irrigation and soil cover conditions; and the effects of this interaction on water resource economics and watermelon development. To do this, field experiments were performed after field surveys with irrigators. These field experiments were conducted under a randomized complete block design with subdivided plots and four replicates. The treatments consisted of the combination of four irrigation propositions (three ISAREG propositions: M1 = 100%, M2 = 80% and M3 = 60% of Available Water Capacity in Soil, and M4, irrigation depth used by irrigators), and four subplots, the uncovered soil, denominated C0, covers with rice husks, with white mulching and with black mulching, denominated C1, C2 and C3, respectively. The results were submitted to analysis of variance, and when significant, they were submitted to regression analysis, averages test and trend graphs. It was concluded that the irrigators do not practice the correct management of the irrigation, because the irrigator applies more water than the greater irrigation depth indicated by the ISAREG model (100% of the Available Water Capacity in Soil) throughout the watermelon cycle. In general, plants irrigated with 100% of available Water Capacity and on soils covered by rice husk and white mulching showed better productive characteristics.

Keywords: deficit irrigation; software; *Citrullus lanatus*; living together with semiarid.

1. INTRODUCTION

Growing water scarcity due to population growth and economic development is raising the challenges for agriculture, and new solutions for the management of water resources in irrigated areas are needed, especially in the semi-arid region, where water is limited and wasted. As a consequence, a technical problem of water supply is already perceived that will be increasingly disputed by different human activities, making it necessary to use it in a controlled manner in agriculture [1]. In addition, in the semi-arid region of the Northeast of Brazil, the irrigation management is not properly realized. As a result, in addition to crop yields being below their potential, more water is usually applied than the crops need, resulting in the waste of scarce water resources in the region.

As a solution, the rational management of irrigation aims, among others, to maximize the efficiency of water use, maintaining favorable conditions for soil moisture and plant health, taking into account the climatic conditions of the place of cultivation, as well as the characteristics of crops. Rational water management aims to supply the water needs of crops, providing water at the right time and in the

correct amount, no waste [2]. In addition, high yields can be obtained without necessarily soil being in the field capacity [3].

One of the alternatives to avoid wasting water resources is the use of computational software used in irrigation management that calculates water requirements based on climate, soil and crop data [2]. As an example, the ISAREG model, which is a simulation software for soil water balance, developed at the Higher Institute of Agronomy, in Portugal, which is able to deal with capillary ascension and percolation through the root zone.

The ISAREG model has been used as a new technology in irrigation management in several countries, being able to assist in the simulation of irrigation depth in order to maintain soil moisture in different percentages of the maximum storage.

Another way to reduce the use of water resources in agriculture is through the use of ground cover, which is a simple technology and whose benefits over crop production and productivity are irrefutable, especially in situations of low water availability, reducing the frequency of cultural practices and the production costs.

Several authors cited by [4] prove the benefits of this technique: a) it improves the quality of the products, like the production of strawberry, pumpkin and watermelon; b) it increases the productivity of crops; c) it extends the time of water availability in the soil; d) it reduces soil temperature variations; e) it reduces the development of weeds; e, f) it reduces or eliminates the possibility of erosion by blocking the direct impact of rainfall and provides savings in the costs of agricultural production.

In addition, the interaction between these technologies can increase agricultural productivity and reduce the use of water resources. It is possible that the irrigation depth dimensioned by the ISAREG model to maintain the bare soil at 80% of the available soil water capacity may be enough to keep the soil under rice husk at 100% of the available soil water capacity, due to less evaporation under this condition.

The research aimed to compare the irrigation proposals generated from the ISAREG model with irrigation management adopted by irrigators of the Jaguaribe - Apodi Irrigation District, evaluating and analyzing the fruit development variables and crop productivity under the different irrigation and soil cover conditions; and the effects of this interaction on water resource economics and watermelon development.

2. MATERIAL AND METHODS

The research was carried out in the UEPE (Teaching, Research and Extension Unit) of the Federal Institute of Education, Science and Technology - IFCE, in Limoeiro do Norte-Ceará (05°06'38 "S; 37°52'21" W; 145.95 m), in the Irrigation District Jaguaribe - Apodi.

The local climate is BSw'h', semi-arid, according to Köppen's climatic classification, with the following average conditions: relative humidity (66.1%), rainfall (717.1 mm) and air temperature of 26.9 °C.

Two consecutive experiments were carried out with the watermelon culture. All the methodologies and analyzes performed were identical for the 2 cycles, except for the irrigation depth simulated by the ISAREG model.

The input data used in the ISAREG model were: field capacity humidity; permanent wilting point; Phenological stages of the crop (1st stage - from planting to first irrigation, 2nd stage - beginning of vegetative growth, 3rd stage - total cover and flowering, 4th stage - fruit formation, 5th stage - leaf senescence and 6th phase - harvest and end of the cycle); water availability factor (f) and effective depth of the root system (Z), both for each phenological phase. Also, the model required data on irrigation management, in which three (3) were calculated by ISAREG (Irrigation with deficit - 60%, 80% and 100% of CAD) and the other one consisted of the mean leaf of 6.3 mm.dia⁻¹, during the watermelon cycle, practiced by the irrigator of DIJA. This irrigation management was the fourth irrigation condition added to ISAREG.

The research was conducted by cultivating the watermelon culture (*Citrullus lanatus*) under proposals of the ISAREG model and the management used by the producers with and without the use of soil cover.

For this, the experiment was carried out in a randomized complete block design with subdivided plots and 4 replicates (4 x 4 x 4, totaling 64 subplots). The treatments consisted of the combination of 4 irrigation propositions (three propositions of the ISAREG model and one irrigation management used by the producers named M1, M2, M3 and M4), which constituted the plots, and 4 subplots, with 3 conditions of soil coverage with rice husk, with white mulching and with black mulching, denominated C1, C2 and C3, and subplot 4, the soil without cover (control), denominated C0.

The irrigation propositions by the ISAREG model were: M1, the optimal irrigation management (irrigation depth proposed for daily soil maintenance in its maximum storage capacity, 100% of available water capacity, without percolation, for an uncovered soil); M2, proposal of daily irrigation for maintenance of storage of uncovered soil water, around 80% of available water capacity; M3, proposal of daily irrigation for maintenance of storage of uncovered soil water, around 60% of available water capacity; and the M4 treatment represented the daily irrigation depth used by local irrigators.

The crop spacing was 2.0 m x 0.5 m, each sub-plot with 6 plants, with 6.0 m² (2.0 m x 3.0 m). The analyzed variables were obtained in the area occupied by 4 plants in the center of the planting row.

There was a borderline between the lines with treatment, making nine lines (9.0 m x 2.0 m = 18.0 m width). Each block had four subplots per treatment, with area of 216.0 m² (18.0 m x 12.0 m). The total area of the experiment was 864.0 m² (18.0 m x 48.0 m).

The sowing of the 1st cycle was carried out on August 15 and 2nd cycle on November 12. They were carried out in styrofoam trays with 128 cells with commercial substrate. Transplanting occurred on August 22 (1st cycle) and November 19 (2nd cycle).

The amounts of the chemical fertilizers used to supply the crop requirements were recommended according to the soil analysis results. However, for the determination of the frequency of fertirrigation application, the research carried out by [5] was used as the basis, which in his search verified better results with daily applications, throughout the watermelon cycle. Fertilizers were applied via fertirrigation, starting on the day of transplanting and ending at 50 DAT (days after transplanting). The commercial chemicals used were urea (N), white potassium chloride (K₂O), phosphoric acid (P₂O₅), sulfur sulfate (S) and boric acid (B).

The control of weeds was carried out during the crop cycle, with weeds, using hoes, in the inter - rows and manual thinning near the plants.

White fly, cochineal and fungus attack were observed, and they were controlled with the rational use of insecticides and fungicides.

The first and second cycles were started when the fruits reached the point of physiological maturation, with a minimum °Brix around 8°, determined with a portable refractometer.

The periodic harvests were carried out at intervals of five days, beginning at 67 days after transplanting. Two harvests were made, with commercial fruits weighing more than 0.80 kg, normal and non-spoiled.

The daily irrigations were performed with self-compensating drippers, average flow of 2.3 L h⁻¹, service pressure of 300 kPa.

The crop evapotranspiration (ET_c) data were obtained through local experiments, by soil water balance methodology; and reference evapotranspiration (ET_o) was estimated by Penman - Monteith / FAO, described by [6], with data from local climatic variables. The crop coefficient (K_c) was obtained by the ratio between ET_c and ET_o.

The irrigation time was calculated from the irrigation depth proposed for each treatment, according to equation 1.

$$Ti = \frac{L_i * E_L * E_g * F_C}{E_i * q_g} \quad (\text{Equation 1})$$

Where: Ti is the irrigation time, in hours; Li is the irrigation depth proposed by each treatment on the ISAREG model; EL is the spacing between irrigation lines, 2.0 m; Eg is the drip spacing, 0.5 m; FC is the soil cover factor, dimensionless; Ei, is the irrigation efficiency, dimensionless (0.95); qg, is the flow of the dripper (2.3 L h⁻¹).

The application of the coverage factor (Fc) of the watermelon cycle, which represents the relationship between the wet area and the area occupied by the crop, was followed by the recommendation of [7], when he stated that Fc should be of at least 33% (0.33) for arid and semi-arid regions. They were also used the results of [8]. The Fc used varied from 0.33 to 1.00 (phase of maximum water demand of the crop).

Tensiometers were installed at 20 cm depth to verify soil moisture at the effective depth of the watermelon root system.

The soil cover used was rice husk (C1), mulching white (C2), mulching black (C3) and without cover (C0)

The variables analyzed were average fruit weight, average productivity and number of fruits per plant.

The qualitative results were submitted to analysis of variance. The results were submitted to the Tukey averages test at 1% and to 5% of probability when significant by the F test. The quantitative variables were submitted to regression analysis.

3. RESULTS AND DISCUSSION

Number of fruits per plant, average fruit weight and average productivity in First (1st) cycle

From the analysis of variance (Table 1), a significant effect was observed for the interaction between irrigation depth versus soil cover, for the following analyzed variables: number of fruits per plant (P <0.05), average fruit weight (P <0.01) and average productivity (P <0.01).

Table 1. Summary of analysis of variance and significance levels for the variables: number of fruits per plant (NFP), average fruit weight (AFW) and average productivity (AP) - 1st cycle

VS	DF	Medium Square		
		NFP	AFW	AP
Irrigation depth (I)	3	0.09563*	5.08333**	511.02042**
Residue (a)	12	0.02187	0.10083	0.94094
Covers (C)	3	0.57229**	10.27000**	2171.01042**
Interaction I x C	9	0.05451*	1.79667**	118.92333**
Residue (b)	36	0.02299	0.04417	0.61455
Total	63	-	-	-
CV % (I)	-	10.31	6.43	1.58
CV % (C)	-	10.57	4.26	1.28

VS= Variation source; DF = Degree of freedom; CV= coefficient of variation; * and ** = Significant at 5% and 1% respectively

Through the regression analysis (Figures 1A and 1B), it was verified that the different irrigation depths, in the absence and presence of soil cover, showed a polynomial effect, under the number of fruits per plant and average fruit weight.

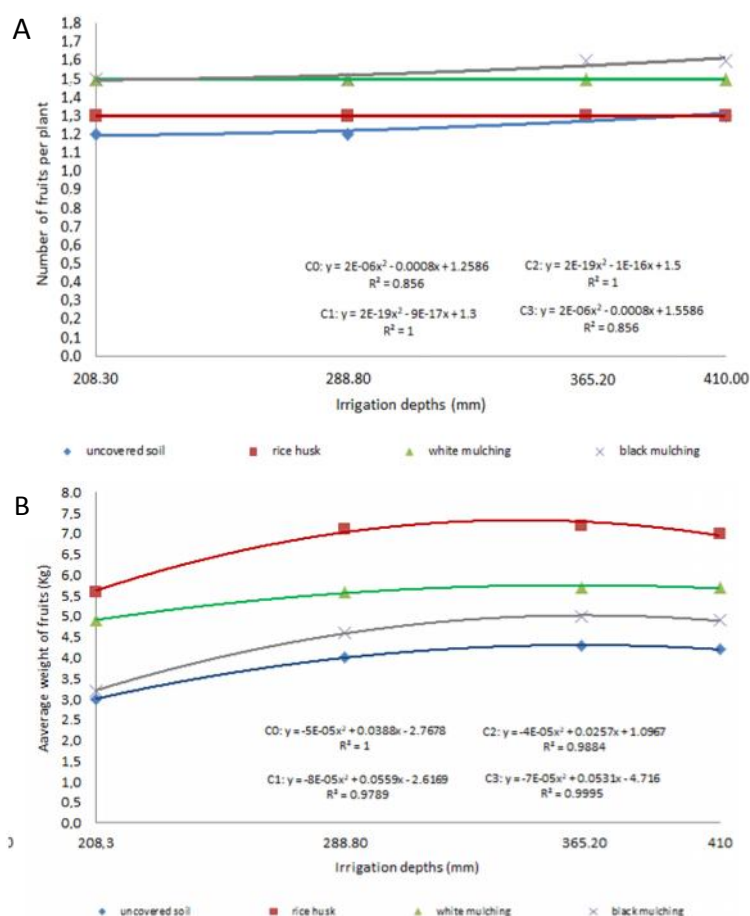


Figure 1. Influence of irrigation depths and soil cover conditions on the number of fruits per plant (A) and average fruit weight (B) of watermelon, during the first cycle.

In Figure 1A, when analyzing the interactions of the irrigation slides with the coverings in the soil, it is verified that there is a pattern of increase of the number of fruits per plant, in relation to the amount of water applied, until the blade M1 (365.2 mm), which is evidenced in uncovered soil conditions and black mulching. Likewise, [9], evaluating irrigation methods in watermelon production, verified that the applied blade influences, to a certain extent, the number of fruits per plant.

The irrigation blade M1 (365.2 mm) and M4 (410 mm), with a black mulching cover resulted in the highest numbers of fruits per plant (1.6). However, the uncovered soil, mainly with the lowest irrigation depth (208.3 mm), resulted in the lowest number of fruits per watermelon plant (minimum of 1.2 and maximum of 1.3). This was probably due to the lower humidity in the soil. This was verified by [10], they reported that water deficiency causes a marked decrease in physiological activities, mainly in the division and growth of cells and, consequently, in the growth and production of crops. According to [11] and [12], the water deficit during flowering and the birth of fruits decrease the number of fruits per watermelon.

Through the regression analysis of Figure 1B, it was verified that the different irrigation depths, in the absence and presence of soil cover, provided a polynomial effect on the average weight of the fruits per watermelon. The same observation was verified by [13], when researching the production of the watermelon subjected to water stress, concluded that the increase of the irrigation depths provided a similar response regarding the average weight of the fruit.

When analyzing the interactions of the irrigation depths with the coverings in the soil, it was verified that there was a positive interaction, regarding the average weight of the fruits, that is, with the increase of the applied irrigation depth, up to the limit of M1, the records of fruit weight were higher,

regardless of the type of coverage. This can be explained by the ISAREG model simulations, which predicted water excess in the soil, when applying a irrigation depth larger than 365.2 mm (M1).

Regarding soil cover, the heavier fruits were verified in the combinations with rice husk and the less heavy ones in the soils without cover. Among the soils covered by plastic, better results were verified in soils covered by white mulching. It can be affirmed that the use of soil coverages assists in the retention of moisture in the soil besides favoring other positive aspects to the development of the watermelon.

[14] researching the tomato crop in different types of soil coverings, found that the use of soil cover contributes to the increase of fruit mass.

As in the other types of coverings, in the condition of uncovered soil the effect increased until the M1 blade, reaching a maximum weight of 4.3 kg. However, it was possible to observe the primary influence of the amount of water applied, on the average weight of the watermelon fruits. [15] verified average weight of watermelon fruits of 3.6 kg, when they performed a similar experiment. [5], in an experiment with irrigated watermelon, but under different conditions of applied irrigation depth, verified average maximum and minimum fruit weight of 10.2 kg and 7.1 kg, respectively.

The combination of the M1 irrigation depth with a soil covered by rice husk resulted in the highest average fruit weight (7.2 kg). The lowest average weight fruit (3.0 kg) was obtained from the M3 irrigation depth (208.3 mm) in the soil without cover. As occurred in the number of fruits per crop, the lowest average fruit weights were observed in the soil without cover, independent of the irrigation depth. With lower humidity in the soil without cover, fatally, the fruits would grow less, reaching lower weights, because according to [16], when it comes to watermelon, the water deficit tends to reduce the average weight of the fruits, making them unacceptable in the consumer market.

According to a regression analysis of the mean values of total productivity (Figure 2), the irrigation depths and coverings in the soil promoted a polynomial effect.

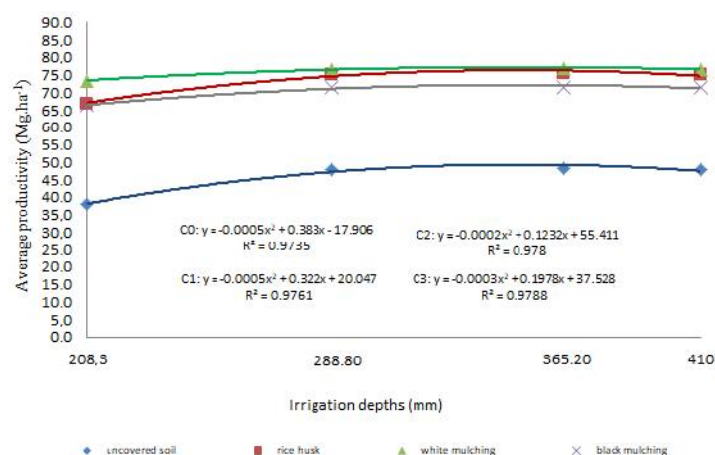


Figure 2. Influence of irrigation depths and soil cover conditions on the average productivity of the watermelon during the first cycle.

In the analysis of the interactions between the irrigation blades and the coverings in the soil, it was verified that there is a pattern of increase of the average productivity of the watermelon, in relation to the amount of water applied, independent of the type of cover in the soil. [17] analyzing the water deficit in watermelon, found higher productivity in the treatment without deficit. [18] found a similar result, they affirm that such behavior is associated to the maintenance of adequate soil water contents for the crop, allowing a greater absorption of water and nutrients, which is responsible for a greater proportion of photoassimilates translocated from the leaves to the reproductive organs, which translates into increased production.

M1 irrigation depth (365.2 mm) showed higher productivity (77.0 Mg ha⁻¹) in combination with the soil covered by white mulching, showing the importance of using this cover for irrigated watermelon

cultivation. Analyzing the watermelon productivity for the soil covered with white mulching, maximum productivity (74.38 Mg ha^{-1}) was observed with a 308 mm applied irrigation depth. [15] analyzing the productive characteristics of irrigated watermelon, reached average values of total productivity of 76.1 Mg ha^{-1} . [19], in a research carried out in Mossoró city with irrigated watermelon cultivation in different soil coverages, verified maximum and minimum yields of 93.1 Mg ha^{-1} and 72.2 Mg ha^{-1} , respectively.

The lower watermelon productivity was observed in the soil without cover for the M1 irrigation depth. [20] analyzing the yield and quality of the melon under irrigation depths and soil cover, verified that there was a 51.5% increase in fruit yield produced with the use of the cover in the soil, in relation to the uncovered soil. [21] evaluated the productive aspects of melon as a function of irrigation depths and soil cover in the city of Baraúna and they verified a productivity of about 14% higher in soil covered by black mulching compared to the uncovered soil.

The highest watermelon yields were verified in the soil covered by white mulching for the M4, M2 and M3 irrigation depths. It is possible to verify the positive relation of the use of white mulching in the soil cover in the increase of the productivity of the watermelon crop, mainly due to the retention of humidity. [22] found that the water reduction can contribute substantially to the decrease of watermelon productivity in certain phenological stages of the crop.

The lower productivity of the watermelon was observed with the application of the lowest irrigation depth in the soil without cover. It was 38 Mg ha^{-1} . This behavior has a physiological explanation, because according to [10], the water deficit can cause a marked decrease in physiological activities, mainly in the division and growth of the cells and, consequently, in the growth of the crops. This deficiency can also cause the stomata to close, decreasing the intracellular concentration of CO_2 , generating a decrease in its assimilation, damaging the crop yield.

In the productivity analysis, with white mulching, rice husks and black mulching, in descending order, the best results were obtained, which demonstrates the technical advantage of using soil cover in watermelon cultivation.

Soil coverages with polyethylene films have led to an increase in growth and productivity in several crops [23]. In addition to the efficiency of the coverages, deficit irrigation calculations using ISAREG proved to be effective in irrigation management.

Number of fruits per plant, average fruit weight and average productivity in Second (2nd) cycle

From the analysis of variance (Table 2), a significant effect ($P < 0.01$) was observed for the interaction between irrigation depths versus soil cover, for the following analyzed variables: number of fruits per plant, average fruit weight and average productivity.

Table 2. Summary of analysis of variance and significance levels for the variables: number of fruits per plant (NFP), average fruit weight (AFW) and average productivity (AP) – 2nd cycle

VS	DF	Medium Square		
		NFP	AFW	AP
Irrigation depths (I)	3	0.13667**	2.20917**	302.64229**
Residue (a)	12	0.00917	0.06667	0.46146
Covers (C)	3	0.63000**	14.78250**	2119.70562**
Interaction I x C	9	0.09000**	2.52694**	446.77840**
Residue (b)	36	0.01139	0.08444	0.33521
Total	63	-	-	-
CV % (I)	-	6.90	4.23	1.09
CV % (C)	-	7.69	4.76	0.93

VS= Variation source; DF = Degree of freedom; CV= coefficient of variation; ** = Significant at 1%

The regression analysis (Figures 3A and 3B) showed the polynomial effect on the number of fruits per plant and the average weight of the fruits of the watermelon.

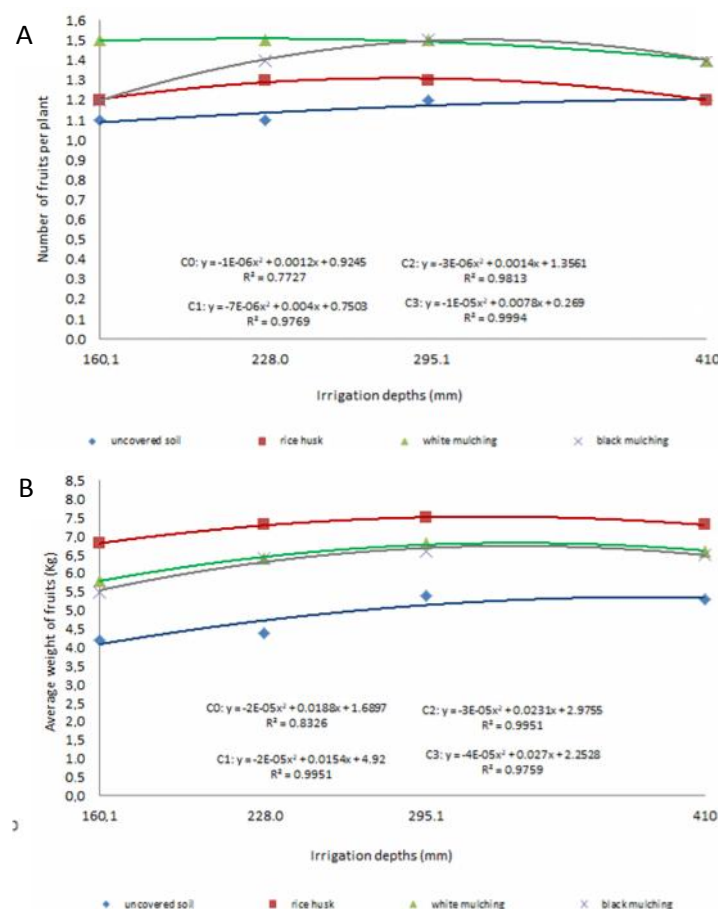


Figure 3. Influence of irrigation depths and soil cover conditions on the number of fruits per plant (A) and average fruit weight (B) of watermelon, during the second cycle.

The same tendency of the first cycle of watermelon was verified for the interactions between irrigation depths and soil cover (Figure 3A).

As in the analysis of the first cycle of watermelon, the combinations of soils covered by "mulching" (white and black) generated better results, that is, a greater number of fruits per crop. However, in the uncovered soil condition, regardless of the applied irrigation depth, the number of fruits per watermelon plant was lower (1.1), with the lowest amount of fruits per crop being observed. Similar results were observed by [9].

The combination of the irrigation depth M1 in a soil covered by white mulching resulted in the highest number of fruits per crop (1.5). [19], in a research carried out in Mossoró city, with irrigated watermelon cultivation and in different soil coverages, verified average maximum number of fruits per watermelon equal 2.0. This increase can be explained by the higher plant spacing used. The lowest numbers of fruits per watermelon plant (1.1) were obtained with the lowest irrigation depth (160.1 mm) in the soil without cover. A similar result to that obtained in this study was observed by [21], who, when analyzing the influence of irrigation slides on the production of Cantaloupe melon, observed that the reduction of the irrigation blade determined the reduction of the number of total fruits and the number of fruits for the domestic market.

In the regression analysis of Figure 3B, it was verified that the different irrigation depths, in the absence and presence of soil cover, promoted a polynomial effect on the average weight of the watermelon fruits. [14] analyzing the influence of black and white mulchings on the productive characteristics of vegetables, verified an interactive effect among the variables analyzed by them. Research has shown higher yields with mulching, especially with increasing soil water in arid and semi-arid conditions [24] and [25].

Regarding the soil cover used in the second cycle of watermelon cultivation, as well as in the first cycle, the heavier fruits were verified in the combinations with rice husk and the less heavy ones in the soils without cover. Among the soils covered by plastic, better results were verified with the use of white mulching. This result also demonstrates the effectiveness of plastic coverings in watermelon cultivation. [26] investigating the effect of mulching on the watermelon production characteristics in the state of Kentucky concluded that the plastic cover provided higher average fruit weights when compared to other non-plastic coverings.

The combination of the M1 irrigation depth (295.1 mm) in a rice husk soil resulted in the highest average fruit weight (7.5 kg). [27], in a similar research carried out in Piauí, verified the average weight of the watermelon fruit around 8.0 kg for the largest applied irrigation depth. Conclusion shared by [28], who analyzed the influence of irrigation on the watermelon production, verified heavier fruits with the increase of the applied water blade. [19], investigating the yield and quality of the watermelon cultivated under agrotexile plastic coverings, verified the lowest mean fruit weight values in the control, whose soil had not been covered.

In general, the fruits harvested in the second cycle showed higher average weights than those of the first cycle, since even though it is known that the amount of water is not the only limiting factor for fruit growth, this behavior may have its cause in the climate (less evapotranspiration) of the second cycle, resulting, among other factors, in higher moisture retained in the soil. [27] verified that the fruits of watermelon present in their nutritive composition a percentage of 92.6% of water, so the mass of the fruits is quite related to the water content, which makes the production of this crop quite dependent on water.

Through the regression analysis of Figure 4 the polynomial effect was verified under the average productivity of the watermelon.

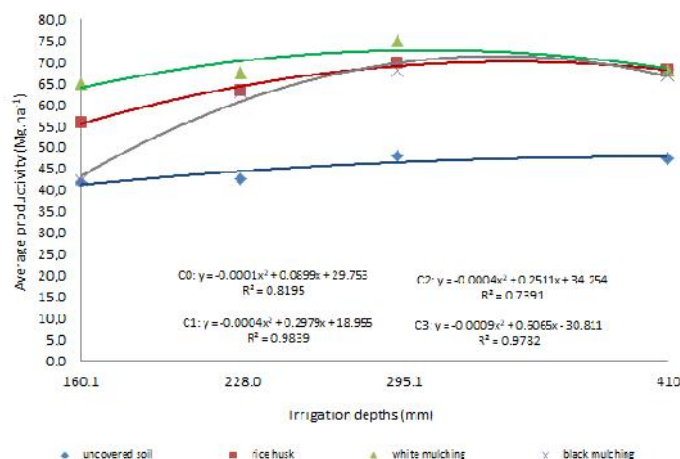


Figure 4. Influence of irrigation depths and soil cover conditions under the average yield of watermelon crop during the second cycle.

The highest watermelon yield was observed in the soil with white mulching cover (75.0 Mg ha⁻¹) with the M1 irrigation depth and the maximum productivity (73.66 Mg ha⁻¹) was obtained with an applied irrigation depth of 314 mm. [27], in a similar research carried out in Piauí, observed total average productivity of watermelon, maximum and minimum, of 95.28 Mg ha⁻¹ and 74.57 Mg ha⁻¹, respectively. The lowest watermelon productivity was observed in the soil without cover (47.9 Mg ha⁻¹) for the same irrigation depth. [29] conducted an experiment with Cantaloupe melon with soil cover, identified that, with the exception of brown plastic, all other plastics provided superior yields to the uncovered soil.

The M3C0 combination showed the lowest productivity with a value of 41.9 Mg ha⁻¹. This may have occurred due to the water deficit provided by the lower irrigation depth and the uncovered soil. [30] observed that watermelon is not very resistant to soil water deficit, since frequent irrigation along the crop cycle significantly increased fruit yield. Several factors may influence fruit growth, however, the cell growth process is a function of cell division and cell expansion, and the presence of water is of

great importance for this occurrence [31]. In comparison, [32], investigating the watermelon culture, verified maximum and minimum yields of 67.5 Mg ha^{-1} and 46.6 Mg ha^{-1} , respectively.

By analyzing the obtained values, in comparison with the results of the first cycle, it was concluded that, independently of the coverings, that the larger the applied blade, to the M1 blade, the greater the productivities. Inclusively, [28], investigating the influence of irrigation slides on watermelon production, found that there is a direct and positive relationship between the applied blade and the watermelon productivity, because in the comparison between the plants irrigated under 100 mm and 500 mm slides, the authors observed an increase of about 13.1 Mg ha^{-1} in average productivity. However, the soil of this experiment has less drainability than the experiment of the aforementioned authors.

As occurred in the first cycle, watermelons cultivated in soils with coverings reached higher yields, the reverse occurring in the condition of uncovered soil. [26] researched the effect of "mulching" on the watermelon production characteristics. They concluded that plastic cover provided higher yields when compared to other non-plastic coverages or uncovered soil.

The ISAREG model proved to be efficient as a strategy in irrigation simulations with deficit. It was verified that the management of irrigation practiced by the irrigators, mainly regarding the waste of water, is not the ideal, because, throughout the cycle of the watermelon, the irrigant applied more water than the need of the crop. [33] obtained similar results when simulating the ISAREG model to analyze the irrigation management of the watermelon crop in Acaraú - CE.

4. CONCLUSION

The irrigators don't practice the correct irrigation management, because they apply more water than the indication of the highest irrigation depth (100% of the available water capacity) by ISAREG model throughout the watermelon cycle. In general, plants irrigated by the M1 irrigation depth and on soils covered by rice husk and white mulching showed better productive characteristics.

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