

INFLUENCE OF PLASTIC MULCH BETWEEN ROWS ON THE YIELD AND QUALITY OF WATERMELON (*CITRULLUS LANATUS*)**DZSENIKER NÉMETH, NOÉMI KAPPEL, GÁBOR BALÁZS**

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ABSTRACT

The watermelon (*Citrullus lanatus*, THUNB. Matsum & Nakai.) is an important and valuable vegetable crop that has the 3rd largest cultivated area in open field in Hungary. Our experiment was set up in the largest and most intensive melon growing area in Hungary, at Dombegyháza in Békés County. Our investigations were carried out with the *Grizzly* watermelon variety and during the experiment 5 different colors of plastic mulch (purple, transparent, green, black, and butter coloured) were used, the control was uncovered. In the field we measured the average weight of the fruits, and during our laboratory measurements we examined the following nutritional characteristics: invert and reducing sugar content, refraction and acidity. Based on the results of the two years of our study we can state that the different color of the plastic mulch did not show significant differences in the examined quantitative and qualitative parameters. Using plastic mulch soil covering between the rows in the watermelon production is likely to continue due to the fact that the fruits remain clean, between the rows the soil remains weed-free, and the problem of labor shortage can be solved with this technology.

Keywords: watermelon, plastic mulch between rows, average, inner content

INTRODUCTION

The watermelon (*Citrullus lanatus*, THUNB. Matsum. & Nakai) is an important and valuable vegetable crop that has the 3rd largest cultivated area in open field in Hungary. In 2016 the sowing area of watermelon was 5500 ha, and ca. 220,000 tons of fruit were harvested (FRUITVEB, 2016). Melon growers face continuous challenges, one of the main problems is the lack of labor. Growers are increasingly looking for technological solutions that has the least manual labor needs. The appearance of the plastic mulch between the rows was a major step in the growing technology. The hand hoeing between the rows is unnecessary with this technology.

It should be mentioned that the purchase and the laying of the plastic mulch foil is a big investment, but it is worth applying due to its positive effects.

Weed control effect has long been known for these foils. The color and the quantity of the transmitted light specify the weed control ability of these foils. Under the transparent foils the weeds are able to proliferate but under dark foils the germination is blocked or if it is not done, they will perish quickly without light (TERBE, 1995).

The rootzone temperature is influenced positively by the mulch, because it can increase or decrease the temperature depending on the foil's color. The right soil temperature supports the development of the seedlings, by making the nutrient uptake easier (DÍAZ-PÉREZ, 2012).

The covering can influence the quality and quantity of fruits. Covering may enable earlier harvest, by generating favorable conditions for the development of the plant. Earliness is influenced by the soil type and the geographical location, too. Under better quality cleaner fruits are meant, because the foil forms a blockade between the fruit and the soil (LAMONT, 1993).

The cover materials proved to be useful in the pest control, too. The rate of photosynthesis, the yield, and the appearance of useful insects and pests is also influenced by the soil covering (MURPHY ET AL., 2009; ZANIC ET AL., 2009; SIMMONS ET AL., 2010).

Those who would like to use this technique, have to count with the additional costs. But we must mention, that the usual 3-4 times of weeding a year between the rows is no longer needed, so the extra expenses are reduced, and the lack of labor is solved too (BALÁZS ET AL., 2017).

RAO ET AL. (2017) compared 6 different colored soil cover plastic mulches with the straw mulch and the uncovered rows in the case of watermelon. In this study, plastic mulches proved to be better than the straw mulch. The best plastic mulch was the silver colored foil, it produced the best yield, the least yield was measured with the uncovered rows.

DÍAZ-PEREZ (2012) experimented with plastic mulch cover in watermelon production. He compared black, blue, grey, red, gold and white foils. Plants covered with gold and white foils showed weaker development, and the most chlorotic leaf's could be found between them.

The biggest yield was measured under the red plastic mulch, and the lowest under the gold one.

We are researching the negative and positive effects of the plastic mulch between the rows on the quantitative and qualitative values of the yield. Our experiment was set up in the largest and most intensive melon growing area in Hungary, at Dombegyháza in Békés County.

MATERIAL AND METHOD

Our investigations were carried out with the 'Grizzly' watermelon variety and during the experiment 5 different colored plastic mulches (purple, transparent, green, black, and butter colored) were used, the control was uncovered. The variety has beautiful colored peelings, is square shaped, and has big yield, these traits make it ideal for the home field marketing. The warm red colored mesocarp indicates great inner contents. The variety has strong vigor and good covering leaves. 'Grizzly' has an excellent fruit set and low sunscald aptitude. The well-developed and trained watermelon seedlings were planted out in 5 rows, in 2016 with 4 repetitions, and in 2017 with 3 repetitions. 35 plants per repeat were used. Between the rows there were 2.2 meters and inside the rows the distance between plants was 0.5 meter. After planting, the seedlings were covered with a low plastic tunnel. After 1-2 days - when the temperature became higher - we made some slits to provide the plants some ventilation. We removed the plastic tunnels at the end of May when blossoming began. After removal of the tunnels, we laid the plastic mulch between the rows immediately, because the watermelon can spread between the rows quickly. Before removing the low plastic tunnel, we used row cultivator. The plastic foil's width was 180 cm in both years with 0.02 mm thickness. Every plastic foil was microperforated, so the rain can flow away from the foils. The foils were laid by hand.

After harvesting the parcel, we examined the weight of the fruits using a digital libra in the field. We calculated the average weight from the measured weights.

During our laboratory measurements, we examined 2-2 watermelon per repeat in the same ripening stage. The following nutritional characteristics were investigated: invert and reducing sugar content, refraction and acidity. The measurement of the refraction was done with a hand refractometer (PAL-1, ATAGO). Our results were specified in Brix°. The sugar content was measured using the Luff-Schorl method. We used the Hungarian standard (MSZ3619-1983) to measure the acidity. For the statistical evaluation of our field

and laboratory results, IBM SPSS 23.0. statistical software package was used. Our experimental results were evaluated by two-factor analysis of variance (ANOVA) for all variables.

RESULTS

We harvested once both years, on the 25th of July in 2016, and on the 15th of July in 2017. We measured the average weight of the fruits. We could not find a big difference between the results of the two experimental years.

In 2016, the transparent colored foil gave the biggest average weight with 7.96 kg/fruit, in 2017 the heaviest fruit was gathered from the purple foil, with a weight of 8.06 kg (*Figure 1*). We observed, that the average weights were more uniform in 2016, but the statistical evaluation did not show any significant difference in the years ($p=0.692$), treatment levels ($p=0.754$) and the two-factor interference ($p=0.770$) in the different years.

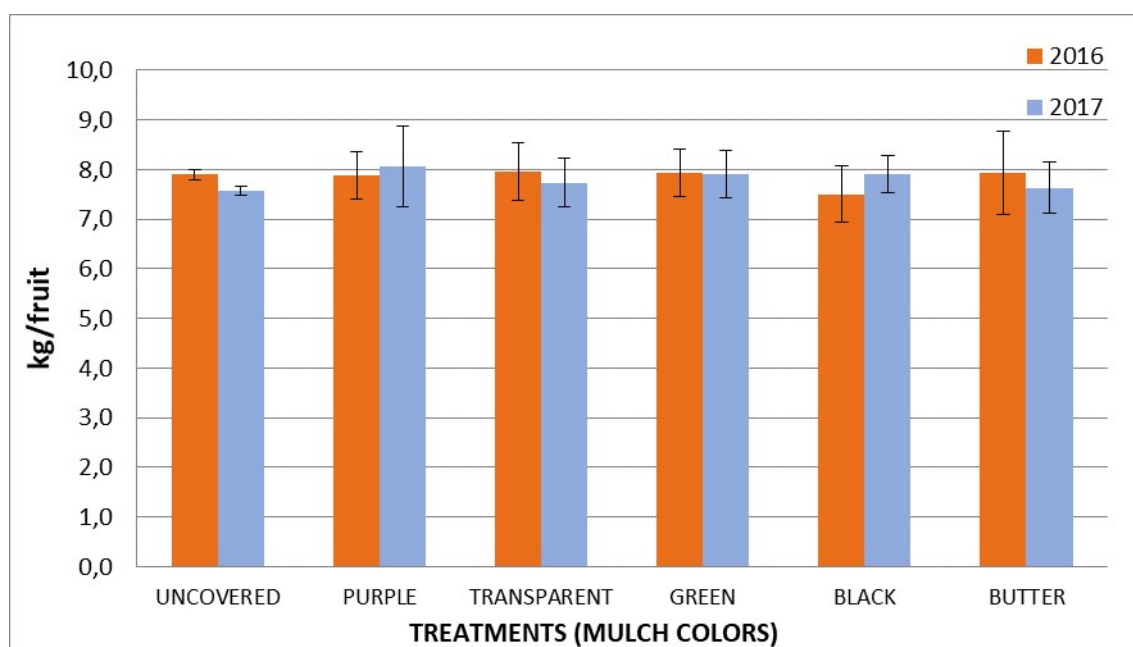


Figure 1. The effect of mulches on the average fruit weight, 2016, 2017

The acidity was between 0.08-0.1% in both years, except for the case of the purple foil mulch where we measured a value of 0.079% in 2017 (*Figure 2*). The uncovered, the purple and the transparent covers resulted higher acidity in 2016. In the case of the green foil, the results of both years were even, and in the case of the black and butter colored plastic mulches the results were higher in 2017. The statistical evaluation did not show any significant difference in the years ($p=0.699$), the treatment levels ($p=0.563$) and in the two-factor interference ($p=0.340$).

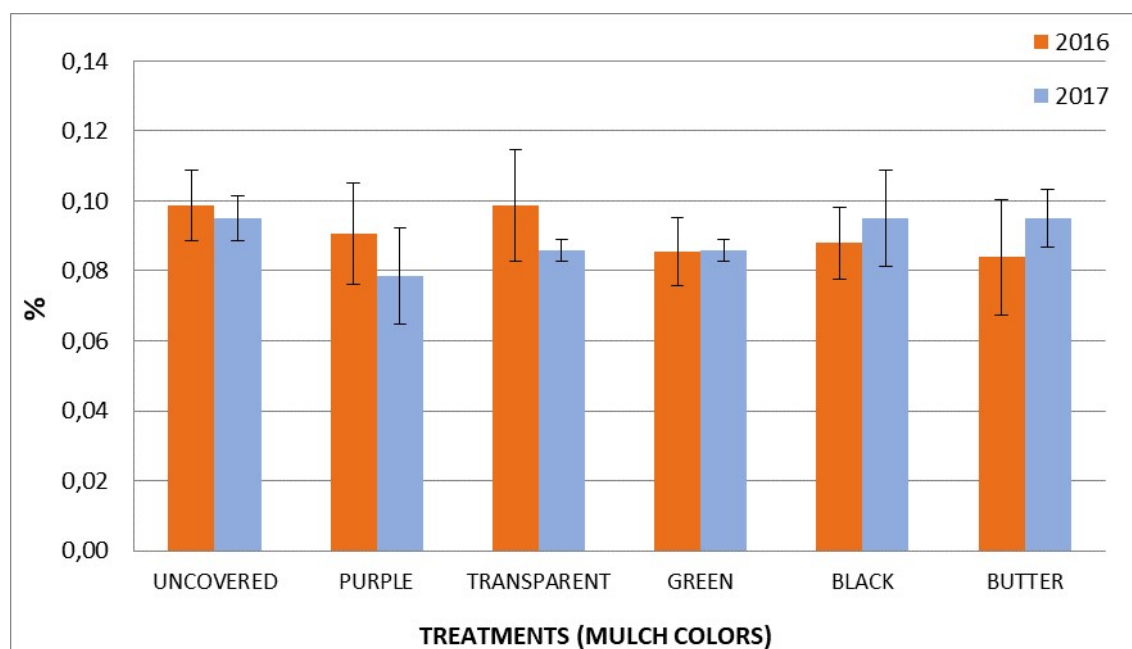


Figure 2. The effect of mulches onto acidity, 2016, 2017

To make the illustration easier, we display the reducing, invert sugar content and refraction results of 2016 (*Figure 3*), and 2017 (*Figure 4*) on separate figures.

In 2016, the highest refraction average value was under the purple foil, with 11.08 Brix° (*Figure 3*), in 2017 11.34 Brix° was the highest, under the transparent foil. We can observe higher refraction levels among the treatments of 2017 compared to 2016, expect for the purple and black foil covers, these resulted in the same average values in both years (*Figure 4*). The lowest refraction level was found under the uncovered and the green foil in 2016, and under the purple in 2017. We could not find significant differences in the years ($p=0.106$), the treatment levels ($p=0.805$), and neither in the two factor interference ($p=0.333$).

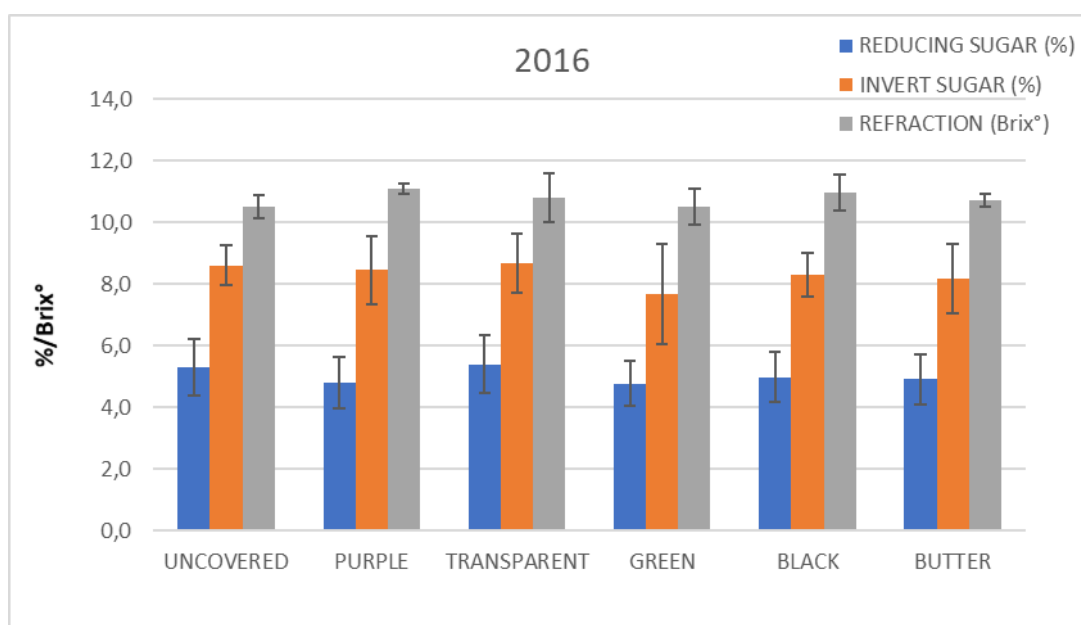


Figure 3. The effect of mulches onto reducing- and invert sugar content and refraction, 2016

We measured the levels of some carbohydrates: glucose, fructose, and sacharose. Glucose and fructose are reducing sugars, sacharose belongs to not-reducing sugars. In 2016, the sugar contents are roughly uniform, we could not find any outstanding values. In both years, the reducing sugar contents were between 4-6%, and all the invert sugar contents were over 8%, expect for the green foil cover in 2016 and the purple cover in 2017 (Figure 4). In the case of the reducing sugar content, we found significant difference between the years ($p=0.039$), but the treatment levels ($p=0.774$) and the two-factor interference ($p=0.460$) did not show any significant difference. In the case of the invert sugar content, there were no significant differences in the years ($p=0.637$), the treatment levels ($p=0.861$) and the two-factor interference ($p=0.127$)

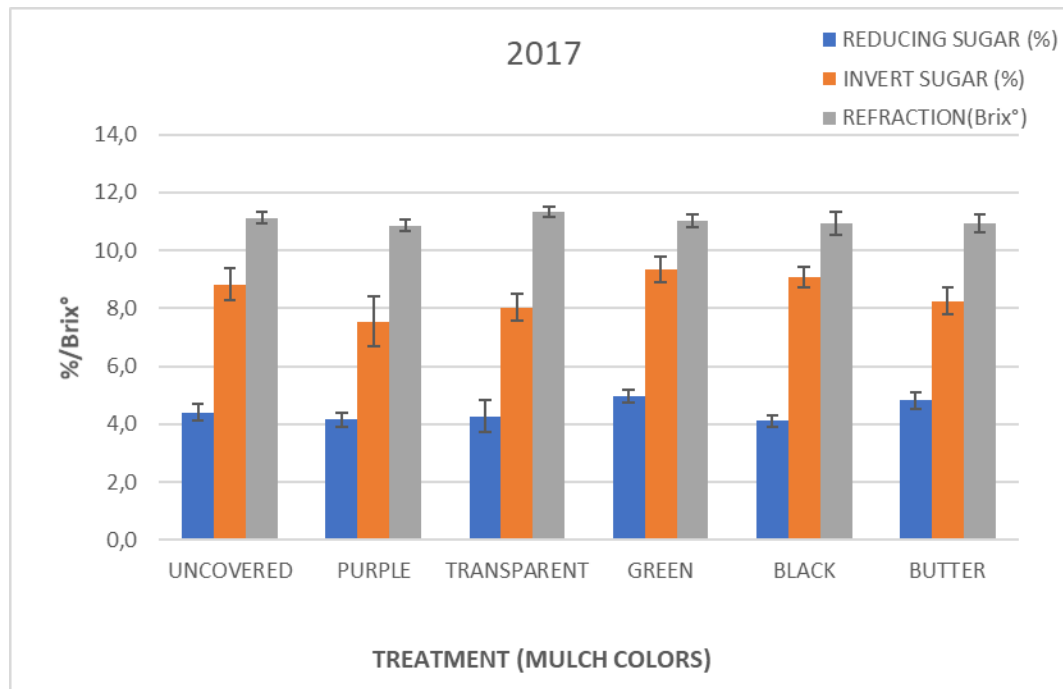


Figure 4. The effect of mulches onto reducing- and invert sugar content and refraction, 2017

CONCLUSIONS

While investigating earliness, we found that the soil covering between rows does not affect the parameter under consideration, which is contrary to LAMONT'S (1993) results that stated that covering would have an effect on the harvest time. None of our experimental years showed any differences in the ripening of the fruits undergoing the different treatments. DÍAZ-PÉREZ (2012) also came to a similar conclusion that the different colored plastic mulches do influence the average yield, but the difference between the average yields of the plants cultivated on the different colored mulches was not significant. According to our calculations, we concluded that the average weight of the fruits was not affected by the different colored plastic mulches. Refraction measurement proved that mulching and different color plastic mulches do not affect the refraction values. This parameter did not show any vintage effect either.

Regarding the content of carbohydrates, it was found that mulching and the color of the covering did not change the reducing and inverted sugar content of watermelon. The study concluded that there is a minimum correlation between refraction and sugar content.

Concerning the acidity, we concluded that only in the case of the green foil mulch were the values equilibrated (equally low) but in general, the mulching and the color of the plastic did not affect the acidity.

We concluded that in the case of any color the films had a good weed control ability, and our harvested crops were cleaner, too, so it is worth to use covering. According to these findings TERBE's (1995) statements can be confirmed and supported.

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