DISTINCTIVE ASPECTS OF EARLY OPEN-FIELD WATERMELON PRODUCTION

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Abstract: This study emphasizes the economic significance of watermelon cultivation in the Republic of Serbia, introducing innovative techniques such as seedling production, grafting, mulching with black polyethylene film and low tunnels. Collectively, these methods contribute to earlier planting, improved crop development, and enhanced fruit quality. Grafting, particularly using *Lagenaria siceraria* and *Cucurbita* species, positively impacts yields and flowering. The incorporation of black polyethylene film aids in weed control, reduces herbicide usage, and minimizes labor inputs. Low tunnels, with transparent film covers, modify microclimates, allowing for earlier harvests. These integrated practices offer a sustainable approach to advancing watermelon cultivation techniques, potentially influencing agricultural practices on a global scale by promoting efficiency, yield optimization, and resource conservation.

Keywords: Watermelon; Open-field; Mulch

1. Introduction

Watermelon originates from Central and South Africa and is considered one of the oldest cultivated plant species [1]. In the Republic of Serbia, watermelon holds significant economic importance as one of the major vegetable crops. Over the past five years, watermelon and melon have been cultivated on an average area of 5,593 hectares, with an average yield of 29.8 tons per hectare and a total production of 166,671.00 tons. Globally, they are cultivated on 3,024,773.6 hectares, with an average yield of 33.4 tons per hectare and a total production of 101,027,438 tons [2].

2. Aspects of Open-Field Watermelon Production

Early watermelon production can be achieved through direct seeding in "hotbeds" or, more commonly and significantly, through seedlings. Seedlings can be grafted, and the cultivation process may involve mulching the soil with plastic film and a combined use of plastic mulching and low tunnels [3].

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Seedlings for early production are produced in containers, cups, pots, bags, and nutrient cubes in protected environments equipped with heating capabilities, with the seedling production period lasting about a month. Sowing for seedling production is done in March, requiring a 20–25 °C temperature. After germination, the temperature should be reduced to 16-18 °C (over a period of 5 to 6 days) to prevent plant elongation, after which the temperature is increased to 20-25 °C. Excessive humidity, high temperature, and reduced light can lead to the formation of tender and elongated plants. Therefore, it is essential to ventilate the protected environment regularly where seedlings are produced. During seedling production, it is necessary to evenly irrigate plants with water at a suitable temperature of 18 °C to 20 °C [4].

Early watermelon production can also be achieved using grafted seedlings. The most commonly used rootstocks for grafting are species such as *Lagenaria siceraria*, followed by *Cucurbita moschata*, *Cucurbita maxima*, and hybrid rootstocks such as *Cucurbita maxima* × *Cucurbita moschata* [5]. The root system of gourds is stronger, better withstands lower soil temperatures and drought, tolerates transplanting more easily, and allows the plant to better utilize nutrients from the soil [6]. It is an essential agronomic measure when cultivating watermelon in monoculture, where plots are infected with *Fusarium oxysporum* f. sp. *niveum*, *Verticillium dahliae*, *Monosporascus cannonballus*, *Rhizoctonia solani*, *Meloidogyne incognita* [7]. Grafting results in significantly higher yields and earlier flowering [5], increases the average fruit weight by about 15% and increases the number of fruits per plant by about 25% compared to non-grafted seedlings [8].

Mulching improves the soil's physical, chemical, and biological properties, increasing crop yields [9]. Laverde [10] notes that there are various colored plastic films available in the market (black, white, brown, blue, green, red, and transparent). Still, in the agroecological conditions of the Republic of Serbia, black polyethylene film is most commonly used for soil mulching (Figure 1). This type of film represents a standard among vegetable producers worldwide due to its excellent characteristics and low cost [11,12]. Simultaneously with the laying of the film, a drip irrigation system is installed. An essential advantage of plastic films is the earlier watermelon harvest due to increased soil temperature and faster crop growth and development [13].

Figure 1. Watermelon production under polyethylene film[1]

[1]Photos by Đ. Vojnović, July, 4th 2023, in the locality Deronje (Vojvodina Province, Serbia).

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Black plastic film, in particular, ensures a watermelon harvest 7-14 days earlier and better fruit quality [14]. Mulching also reduces weed growth, decreases herbicide use, and lowers the labor input for crop cultivation by 65-80% [15].

Low tunnels (Figure 2) are semi-circular greenhouses with a height of 40-60 cm, width of 50-150 cm, and length of 200-400 m, commonly used in vegetable production [16]. Low tunnels find the most significant application for heat-loving plants sensitive to low temperatures [17]. Transparent films ranging from 14 μm [3] to 110 μm [6] cover low tunnels. Low tunnels can modify the microclimate in crops by increasing air and soil temperatures [18], preventing frost damage [19], positively affecting plant growth and development, early maturity, and increasing yields [20]. They simultaneously protect plants from wind, pests, and rain. The combination of soil mulching and plant covering ensures an improved microclimate for crop growth, leading to increased overall and early yields [17].

Figure 2. Watermelon production under low-tunnel conditions[2]

The use of low tunnels allows for watermelon planting to commence one month earlier [20]. In the agroecological conditions of the Republic of Serbia, transplanting watermelon seedlings under low tunnels begins in the first decade of April. The film covering the low tunnels is removed when the danger of low temperatures has passed, and the leaves start touching the film [18]. Thanks to low tunnels, harvesting can start two to three weeks earlier [6].

3. Conclusion

This study underscores the pivotal role of innovative techniques, namely mulching and low tunnels, in advancing early watermelon cultivation. Their combined application enhances microclimatic conditions, allowing for earlier planting and harvesting, and substantially boosts economic efficiency and overall crop yields. These findings underscore the imperative of embracing sustainable practices in modern agriculture.

[2]Photos by Đ. Vojnović, May, 8th 2020, in the locality Buđanovci (Vojvodina Province, Serbia).

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References

[1] C. Szamosi, I. Solmaz, N. Sari, C. Bársony, Morphological characterization of Hungarian and Turkish watermelon (Citrullus lanatus (Thunb.) Matsum. et Nakai) genetic resources, Genet Resour Crop Evol 56 (2009) 1091–1105. https://doi.org/10.1007/s10722-009-9432-4.
[2] FAOSTAT, (Accessed on 10/01/2024), (2024). https://www.fao.org/faostat/en/#data/QCL.
[3] B. Adamović, D. Paroški, Đ. Vojnović, Ž. Ilin, The effect of mulching and low tunnel on the yield, yield components and quality of watermelon, Acta Hortic. (2020) 101–108. https://doi.org/10.17660/ActaHortic.2021.1320.13.
[4] M. Đurovka, Ž. Ilin, Bostan, Poljoprivredni fakultet, Novi Sad., (2002).
[5] H. Yetisir, N. Sari, Effect of different rootstock on plant growth, yield and quality of watermelon, Aust. J. Exp. Agric. 43 (2003) 1269. https://doi.org/10.1071/EA02095.
[6] A. Balliu, Early production of melon, watermelon and squashes in low tunnels, ISHS, Acta Hortic 1 (2017) 341–351. https://doi.org/978-92-5-109622-2.
[7] M. A. Spain, Use of grafted cucurbits in the mediterranean region as an alternative to methyl bromide, in: Lisbon, Portugal, 2005: pp. 75–80.
[8] V. Rašković, M. Đurovka, Uticaj kalemljenja na broj plodova, prosečnu težinu ploda i prinos po biljci, Savremena Poljoprivredna Tehnika 35 (2009) 157–218.
[9] E. Kosterna, The effect of soil mulching with organic mulches, on weed infestation in broccoli and tomato cultivated under polypropylene fibre, and without a cover, Journal of Plant Protection Research 54 (2014) 188–198. https://doi.org/10.2478/jppr-2014-0029.
[10] G. Laverde, Agricultural films: Types and applications, J. Plast. Film Sheeting 18 (2002) 269–277. https://doi.org/10.1177/8756087902034.
[11] F.D Schales, Agricultural plastics use in the United States, Proceedings of the 11th international congress the use of plastics in agriculture, New Delhi, India, 26th February-2nd March, (1990) 53–56. https://doi.org/9061919983.
[12] M.M. Moreno, A. Moreno, Effect of different biodegradable and polyethylene mulches on soil properties and production in a tomato crop, Scientia Horticulturae 116 (2008) 256–263. https://doi.org/10.1016/j.scienta.2008.01.007.
[13] D. Ban, K. Zanic, G. Dumicic, T.G. Culjak, S.G. Ban, The type of polyethylene mulch impacts vegetative growth, yield, and aphid populations in watermelon production, Journal of Food, Agriculture & Environment 7 (2009) 543–550.
[14] B. Adamović, D. Paroški, Đ. Vojnović, Ž. Ilin, Impact of polyethilene mulch and low tunnel on yield and watermelon fruit characteristics, Book of Proceedings, XIV International Scientific Agricultural Symposium "Agrosym 2023", Jahorina, 5-8. October, (2023) 494–499.
[15] M. Najafabadi, G.H. Peyvast, Hassanpour, A.M., J.A. Olfati, M. Rabiee, Mulching effects on the yield and quality of garlic as second crop in rice fields, Int. J. of Plant Prod 6 (2012) 1735–1743.
[16] Ž. Ilin, Adamović, B., Ilin, S., Current status and prospects of indoor vegetable growing in the Republic of Serbia, Acta Hortic 1 (2016) 467–473.
[17] N. Soltani, J.L. Anderson, A.R. Hamson, Growth Analysis of Watermelon Plants Grown with Mulches and Rowcovers, Jashs 120 (1995) 1001–1009. https://doi.org/10.21273/JASHS.120.6.1001.
[18] A. López-Martínez, F. Molina-Aiz, M. Moreno-Teruel, A. Peña-Fernández, F. Baptista, D. Valera-Martínez, Low Tunnels inside Mediterranean Greenhouses: Effects on Air/Soil Temperature and Humidity, Agronomy 11 (2021) 1973. https://doi.org/10.3390/agronomy11101973.
[19] R.A. Arancibia, C.E. Motsenbocker, Differential Watermelon Fruit Size Distribution in Response to Plastic Mulch and Spunbonded Polyester Rowcover, Hortte 18 (2008) 45–52. https://doi.org/10.21273/HORTTECH.18.1.45.
[20] A. Ranjan, A. Kumar, S. Prakash, A.K. Pal, Effect of Low Poly Tunnel and Planting time on Growth Parameters and Yield of Muskmelon, Int.J.Curr.Microbiol.App.Sci 8 (2019) 2735–2739. https://doi.org/10.20546/ijcmas.2019.801.289.

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