
EURAF2020
NUORO
EURAF
European Agroforestry Federation
UNINUORO
L'UNIVERSITÀ AL CENTRO
5TH EUROPEAN AGROFORESTRY CONFERENCE
17th - 19th MAY 2021 - ITALY
BOOK OF ABSTRACTS
Agroforestry for the transition towards sustainability and bioeconomy

Shading effect on crop yields in intercropped systems of walnut and agricultural crops

EURAF 2020
Agroforestry for the transition towards sustainability and bioeconomy
Abstract
Corresponding Author: jjovic@fazos.hr

Vladimir Ivezić[1], Helena Žalac[1], Jurica Jović[1], Miro Stošić[1], Dario Iljkić[1], Vladimir Zebec[1]

1 University of J.J. Strossmayer in Osijek, Faculty of Agriobiotehnical Sciences Osijek, Vladimira Preloga 1, 31000 Osijek, Croatia (e-mail: jjovic@fazos.hr)

Theme: Climate change (adaptation and mitigation)

Keywords: buckwheat, tree canopy, solar radiation, yield, wheat

Abstract

Introduction

More frequent decision of farmers to switch from crop production to fruit production (such as walnuts), brought out the question: can we still grow crops within the alleys while waiting for fruit yields? And what would be the shading effect from walnut canopy on crop yields? Although we can expect lower crop yields several ecological beneficial aspects can be observed by intercropping in walnut orchards. Combining permanent woody species with agricultural crops can positively influence the microclimate conditions, which can improve the plant resistance to stress conditions such as more recent climatic extremes (drought, flooding), better use of the production area, positive influence on soil fertility, diversity of production in one vegetation, protection against plant disease, pests and weeds, better use of nutrients and water in soil as well as increased biodiversity (Quinkenstein et al., 2009). The aim of the research is to investigate the shading effect in intercropped systems of walnut orchard and agricultural crops and its effect on crop yields.

Materials and methods

The field trial was set up in eastern Croatia (city of Đakovo) in an 11-yr old walnut orchard where walnut alleys are 8 meter wide. The field trial consisted of three plots - control plot of wheat without walnuts, walnut orchards with intercropped wheat and a walnut orchard without intercropped wheat. Within the alleys a 6m strip was sown with winter wheat in October 2017 and buckwheat in end of May 2019. During the vegetation period during 2018 and 2019 climatic conditions were observed on a stationary meteorological station (temperature, humidity, precipitation, solar radiation, wind speed and direction) at the same time on several occasion (November 2018, April 2019, June 2019, July 2019, September 2019, November 2019) the solar radiation was measured in canopy shade and direct sunlight (middle of the alley) during the clear days without clouds. Crop yields were determined at the harvest (wheat beginning of July 2018 and buckwheat beginning of September 2019).

Results and discussion

There is a significant difference in solar radiation throughout a vegetation period, in canopy shade as well as in direct sunlight. In direct sunlight, middle of the row, the highest solar radiation was measured during the summer months (June and July) when the solar radiation was in range of 100000 - 120000lux on a clear day. In canopy shade highest solar radiation was measured during the month without the leaf (November) when solar radiation was in range of 17000 – 42000 lux. In relative numbers, in November, 85% of solar radiation passes through the canopy, In April 30%, in October 20% and in summer months (June and July) in range of 6 – 8 %. Although only 6% of solar radiation passes through the canopy shade it is still amount of light that is above minimum requirement for wheat. Furthermore by

that time (June), winter crop such as winter wheat is already fully developed and need for light is not of such importance anymore and the shade reduces evapotranspiration during these humid months. On the other hand, buckwheat at that time (June and July) is in its development stage. Buckwheat vegetation is around three months, so from June till September.

The yield results of both crops (winter wheat and buckwheat) have shown statistically lower yields in intercropped orchard compared to control plot. However, the winter wheat, whose vegetation period does not overlap with the walnut vegetation period, had only 11% reduction in yield while buckwheat whose vegetation was overlapping with walnut had 28% yield reduction in intercropped walnut orchard. Such findings confirm the importance of light (Dufour et al., 2013; Talbot et al. 2014). Although, the yields are statistically lower, the reduction in yields is not that severe and further investigation of other parameters that might be influencing crop yields is necessary.

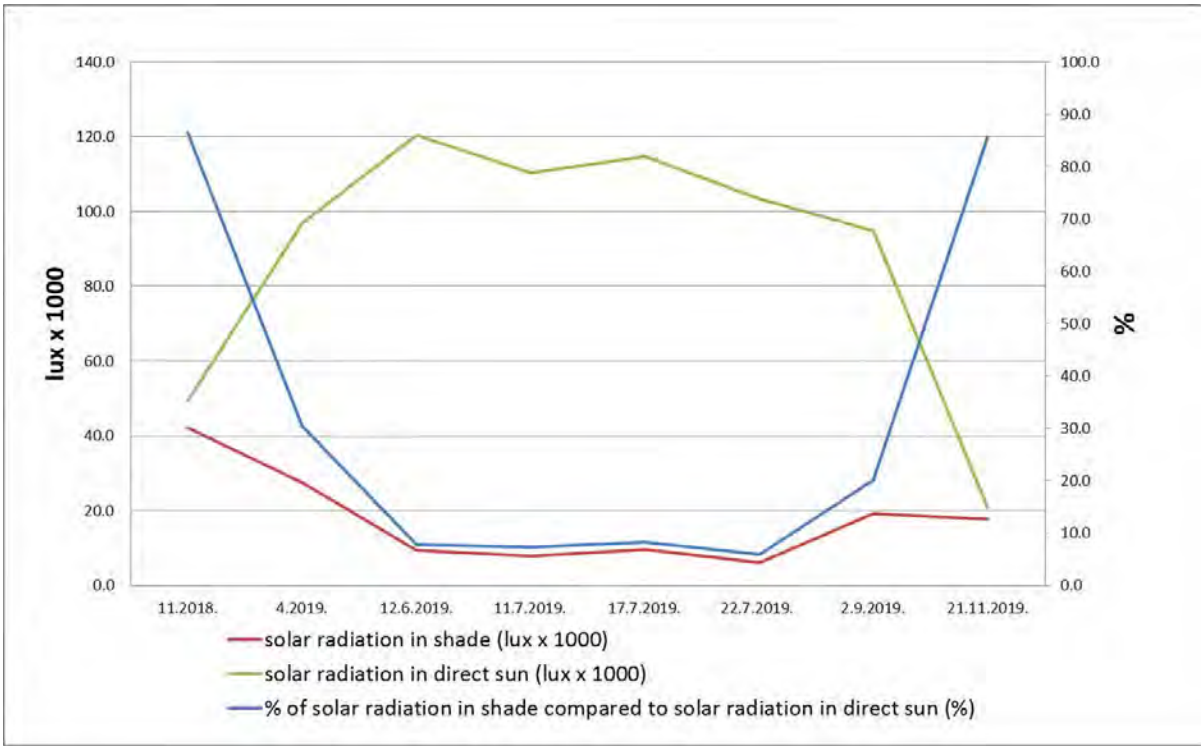

Figure 1. Solar radiation in walnut orchard

Acknowledgment

Authors would like to thank Croatian Science Foundation for funding this research through project UIP-7103 "*Intercropping of wood species and agricultural crops as an innovative approach in agroecosystems*"

References

Dufour L., Metay A., Talbot G., Dupraz C. (2013) Assessing Light Competition for Cereal Production in Temperate Agroforestry Systems using Experimentation and Crop Modelling. J Agro Crop Sci 199:217–227

Talbot G, Roux S, Graves A, et al (2014) Relative yield decomposition: A method for understanding the behaviour of complex crop models. Environ Model Softw 51:136–148 . doi: 10.1016/j.envsoft.2013.09.017

Quinkenstein, A., Wöllecke, J., Böhm, C., Grünewald, H., Freese, D., Schneider, B.U., Hüttl, R.F. (2009). Ecological benefits of the alley cropping agroforestry system in sensitive regions of Europe. Env. Sci. & Policy, 12; 1112-1121