# RESULTS REGARDING THE CORRELATION OF THE GRAIN YIELD WITH THE YIELD OF ABOVE-GROUND BIOMASS AT SUNFLOWER CROP

***Adrian Gheorghe BASA[1*], Viorel ION[1], Georgeta DICU[2], Nicoleta ION[3], Daniel STATE[2]***

*[1]University Of Agronomic Sciences And Veterinary Medicine Of Bucharest, 59 Marasti Blvd, District 1, 011464, Bucharest, Romania*
*[2]SC Procera Agrochemicals Romania Srl, 47 Muncii Street, Fundulea, Calarasi, Romania*
*[3]Research And Development Institute For Beekeeping, 42 Ficusului Blvd., District 1, 013975, Bucharest, Romania*

**adibasa@agro-bucuresti.ro*

## ABSTRACT

Climatic and soil conditions, and the crop technology influence the correlation of the grain yield with the yield of above-ground biomass at sunflower crop. The aim of the paper is to present the results we have obtained at different hybrids of sunflower studied in the specific conditions of South Romania under different environmental and technological conditions regarding the correlation of the grain yield with the yield of above-ground biomass. The grain yields were expressed as yields at 9% moisture content of the grains, while the yields of above-ground biomass were expressed as yields of dry matter. Researches were performed in field experiments in 2013 and 2014 in two locations from South Romania (Fundulea from Calarasi County and Moara Domneasca from Ilfov County). In both experimental years, four sunflower hybrids were studied (Pro 111, Pro 953, LG 56.62 and P64LE19) at three row spacing (75 cm, 50 cm, and twin-rows of 75/45 cm) and three plant densities (50,000, 60,000, and 70,000 plants.ha$^{-1}$). Under the climatic conditions of 2013 and 2014 and in the two locations from South Romania with different soil conditions (chernozem and reddish preluvosoil), the grain yield did not correlated very well with the yield of above-ground biomass, whatever was the row spacing and plant density. However, there are some differences according to row spacing and plant density. Generally, the grain yields correlated negatively with the yield of above-ground biomass, except the situations registered at narrow rows under less favorable climatic conditions, especially when these were associated with less favorable soil conditions.

**Key words:** Sunflower, Correlation, Yield, Grains, Biomass

## INTRODUCTION

Yield is the most economic character in almost all of the crops (Yasin and Singh, 2010). The yield is determined by the so called yield components. In sunflower, yield is determined by the proportions of the various components (Fetri et al., 2013). Sunflower seed yield, like other crops, is dependent of yield components which have interrelation among them and affect the seed yield directly or indirectly (Gjorgjieva et al., 2015).

Plant growth, plant biomass and plant yield are conditioned by different factors (Basa et al., 2014). The yield of achenes and the yield components of the head are specific to each sunflower hybrid, but they are influenced by the different growing factors, such as environmental factors (e.g. soil and climatic conditions) and technological factors (e.g. row

spacing and plant population) (Ion et al., 2015). Under optimal conditions it is expected that grain yield correlates positively, at least to some point with the biological yield, respectively the yield of above-ground dry biomass (Basa et al., 2015). Climatic and soil conditions, and the crop technology influence the correlation of the grain yield with the yield of above-ground biomass at sunflower crop.

The aim of the present paper is to present the results we have obtained at different hybrids of sunflower studied in the specific conditions of South Romania under different environmental and technological conditions regarding the correlation of the grain yield with the yield of above-ground biomass.

## MATERIALS AND METHODS

Researches were performed in field experiments in the years 2013 and 2014, in two locations from South Romania, respectively Fundulea (Calarasi County) and Moara Domneasca (Ilfov County). These two locations represented different soil and climatic conditions. In both experimental years (2013 and 2014), researches were performed in field experiments with four sunflower hybrids, respectively: Pro 111, Pro 953, LG 56.62, and P64LE19.

The soil from Fundulea area is chernozem (cambic chernozem soil). At Fundulea area and for the growing period of sunflower, respectively period April-August, the average temperature was 20.1ºC in 2013 and 18.9ºC in 2014, while the multiannual average value for the same period is 18.6ºC. The sum of rainfall for the same period was 381.1 mm in 2013 and 399.0 mm in 2014, while the multiannual average value is 327.9 mm.

The soil from Moara Domneasca area is reddish preluvosoil. At Moara Domneasca area and for the growing period of sunflower, respectively period April-August, the average temperature was 20.5ºC in 2013 and 18.8ºC in 2014, while the multiannual average value for the same period is 18.5ºC. The sum of rainfall for the same period was 115 mm in 2013 and 408 mm in 2014, while the multiannual average value is 313.2 mm.

At Fundulea area, the rainfall was higher than the multiannual average value, the year 2014 being more humid than the year 2013. At Moara Domneasca area, the rainfall in 2013 was much less than multiannual average value, this year being characterised as a drought one, while 2014 was a humid one with more rainfall than multiannual average value.

Each sunflower hybrid was studied under three row spacing (75 cm, 50 cm, and twin-rows of 75/45 cm), and three plant densities (50,000, 60,000, and 70,000 plants.ha$^{-1}$).

In each location and from each variant, the sunflower plants from one square meter were cut at soil level and were weighed immediately in view to be determined the yield of fresh above-ground biomass. The seeds of sunflower heads were collected and weighed in view to be determined the yield of grains. It was determined the moisture content of the sunflower seeds to let us calculate the yield of grains in kg.ha$^{-1}$ at moisture content of 9%. One sunflower plant for each variant was taken into the laboratory, where it was determined the dry biomass by oven drying at 80ºC for 24 hours, as to be determined the yield of dry above-ground biomass. In both experimental years, the determinations were performed at fully ripe stage. The yield of dry biomass was calculated in kg.ha$^{-1}$ and represents the yield of above-ground biomass.

## RESULTS AND DISCUSSIONS

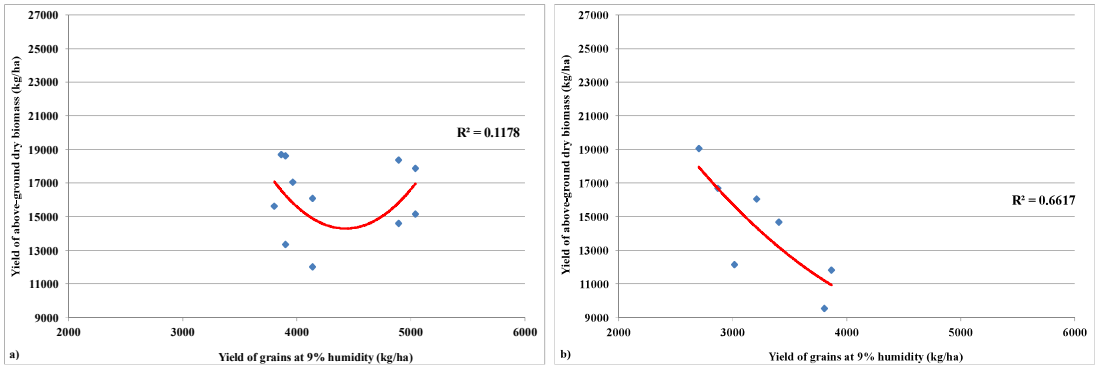
Under the climatic conditions of 2013 and 2014 and in the two locations from South Romania with different soil conditions (chernozem and reddish preluvosoil), the grain yields of the four sunflower hybrids, as average values, did not correlated very well with the yields of above-ground biomass, regardless of distance between rows and plant density (Figures 1-6). However, there are some differences according to row spacing and plant density.

At row spacing of 75 cm, the grain yields correlated negatively with the yield of above-ground biomass in both experimental years and both soil conditions (Figure 1).

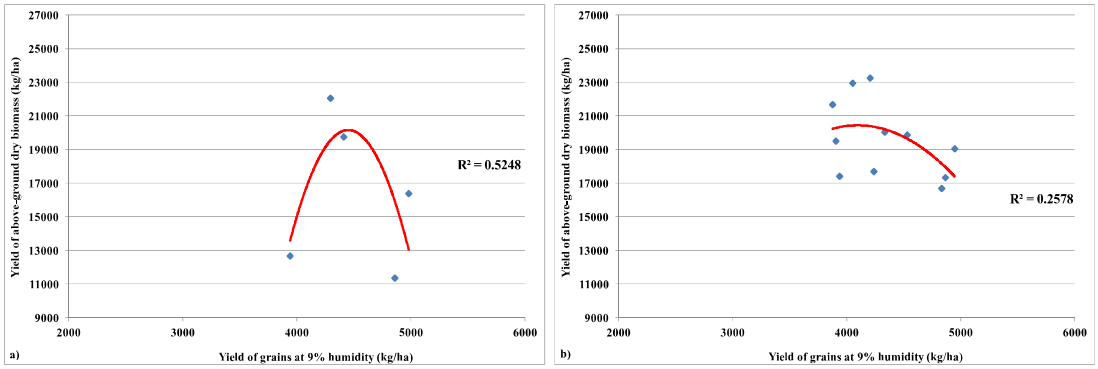
At row spacing of 50 cm, the grain yields correlated positively with the yields of above-ground biomass in the year 2013 under both soil conditions, but especially on reddish preluvosoil which was associated with less favorable climatic conditions, especially drought. In the year 2014, characterized by better climatic conditions for the two soil conditions, the grain yields correlated negatively with the yields of above-ground biomass (Figure 2). These findings can be explain by the fact that under less favorable growing conditions, the sunflower plants produce more grains once the above-ground biomass increase. But, under favorable growing conditions, the sunflower plants react by producing more vegetative biomass than reproductive one, respectively despite the fact that the above-ground biomass increases the weight of seeds decrease. This means that at row spacing of 50 cm and under favorable growing conditions the harvest index decrease.

At twin-rows of 75/45 cm, as in the case of row spacing of 50 cm, the grain yields correlated positively with the yields of above-ground biomass in the year 2013 under both soil conditions, but especially on reddish preluvosoil, which was associated with drought. Also as in the case of row spacing of 50 cm, in the year 2014, respectively under better climatic conditions, the grain yields correlated slightly negatively with the yields of above-ground biomass, especially on reddish preluvosoil (Figure 3).

Generally, at different plant densities, the grain yields correlated negatively with the yields of above-ground biomass (Figures 4-6), except the situation registered at plant density of 50,000 plants.ha$^{-1}$ and reddish preluvosoil (Figure 4) and the situation registered at plant density of 60,000 plants.ha$^{-1}$ and chernozem (Figure 5).

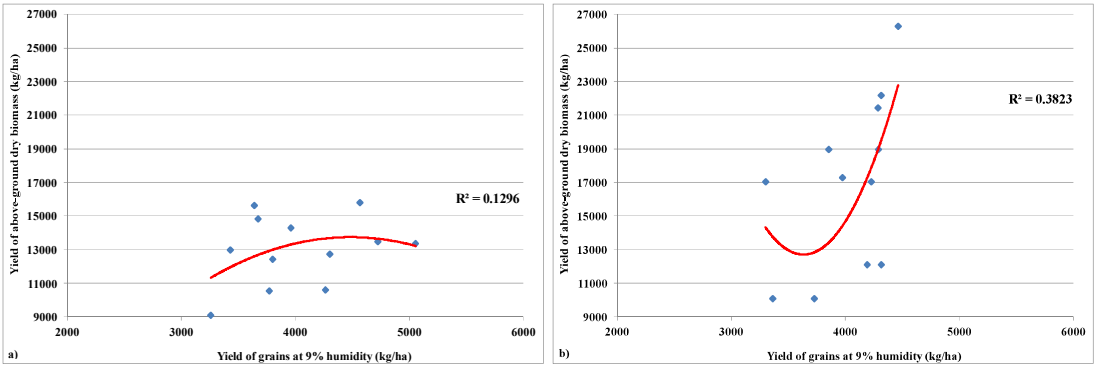



*Climatic conditions of 2013 (a- chernozem soil; b- reddish preluvosoil)*

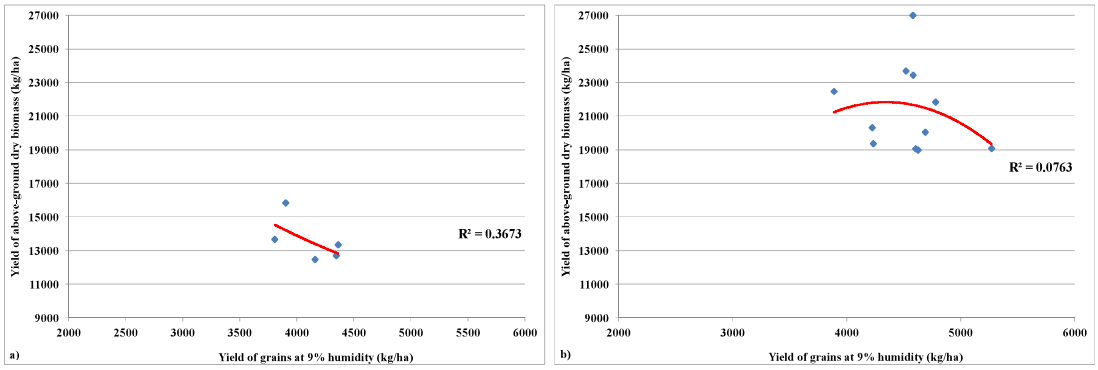



*Climatic conditions of 2014 (a- chernozem soil; b- reddish preluvosoil)*

Figure 1. Correlations of the yield of grains with the yield of above-ground dry biomass at sunflower at row spacing of 75 cm and under different climatic and soil conditions

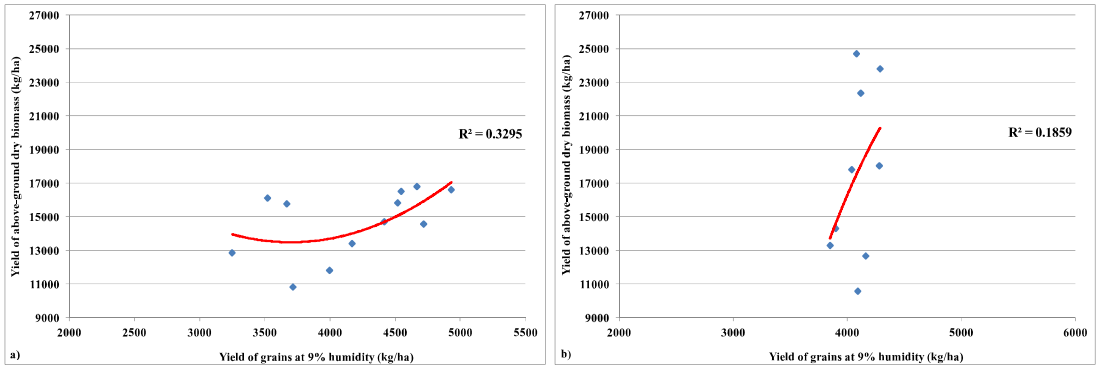



*Climatic conditions of 2013 (a- chernozem soil; b- reddish preluvosoil)*

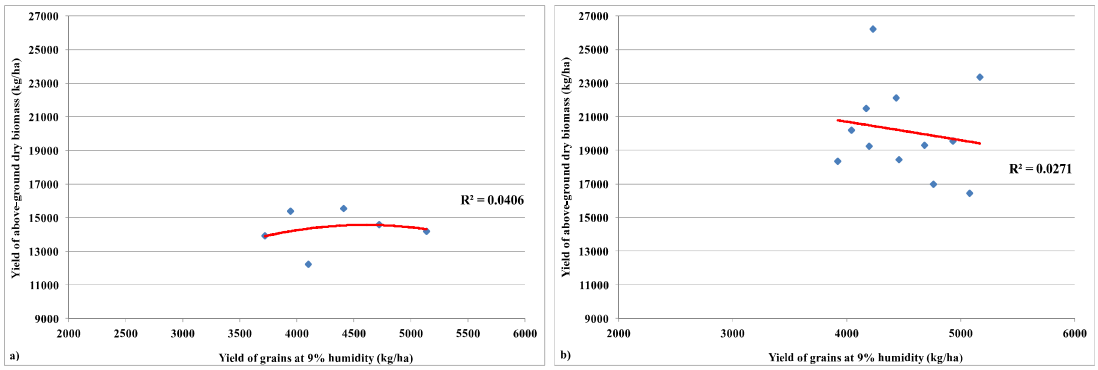



*Climatic conditions of 2014 (a- chernozem soil; b- reddish preluvosoil)*

Figure 2. Correlations of the yield of grains with the yield of above-ground dry biomass at sunflower at row spacing of 50 cm and under different climatic and soil conditions

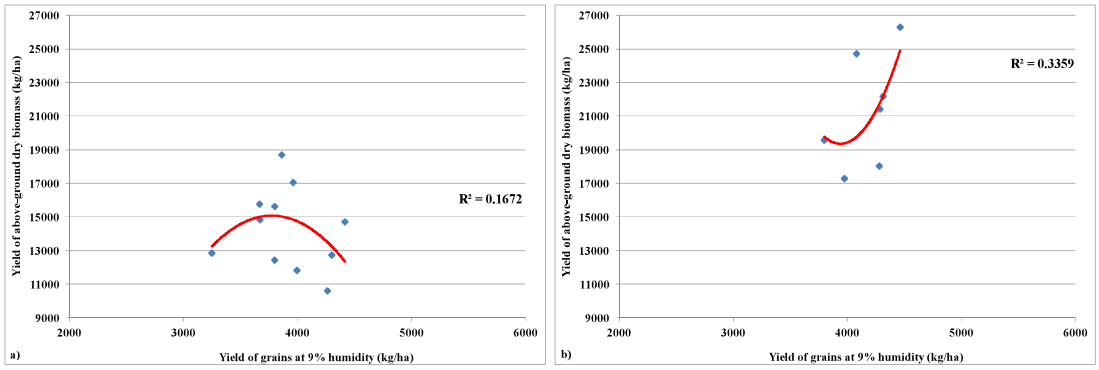



*Climatic conditions of 2013 (a- chernozem soil; b- reddish preluvosoil)*

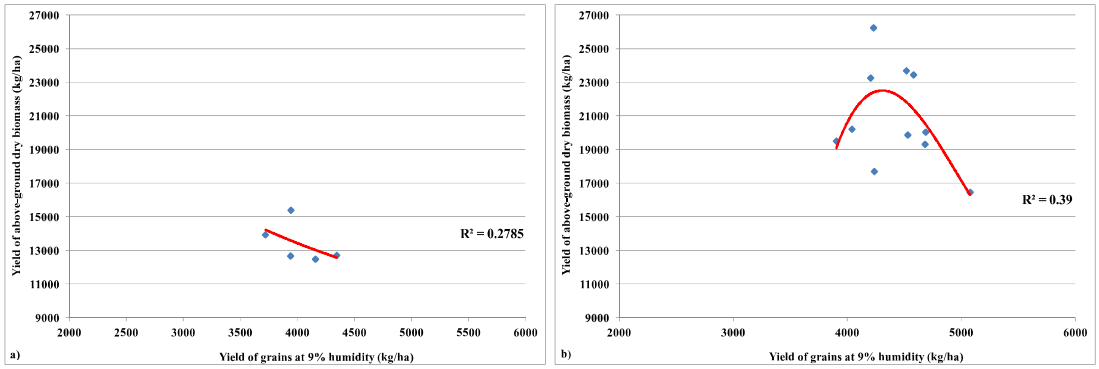



*Climatic conditions of 2014 (a- chernozem soil; b- reddish preluvosoil)*

Figure 3. Correlations of the yield of grains with the yield of above-ground dry biomass at sunflower at twin-rows of 75/45 cm and under different climatic and soil conditions

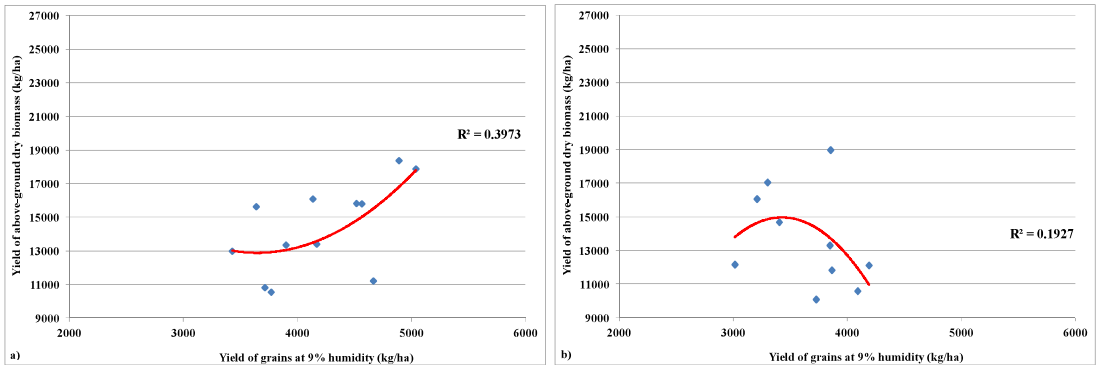



*Climatic conditions of 2013 (a- chernozem soil; b- reddish preluvosoil)*

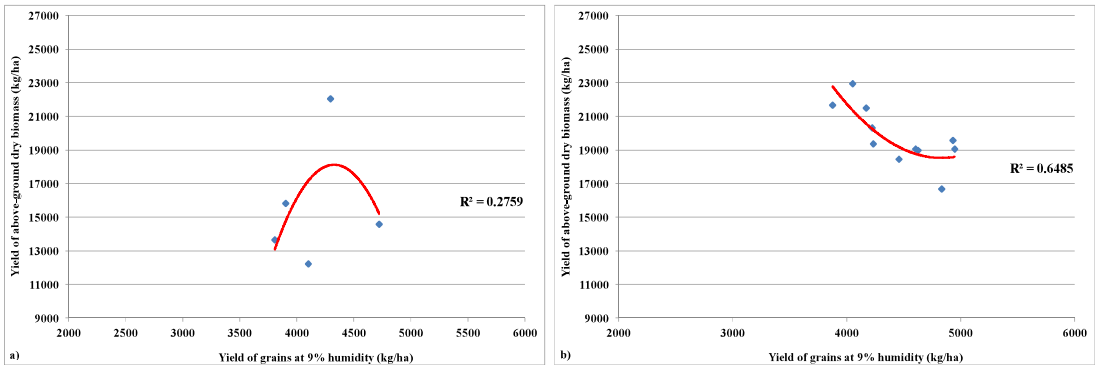



*Climatic conditions of 2014 (a- chernozem soil; b- reddish preluvosoil)*

Figure 4. Correlations of the yield of grains with the yield of above-ground dry biomass at sunflower at plant density of 50,000 plants.ha$^{-1}$, under different climatic and soil conditions

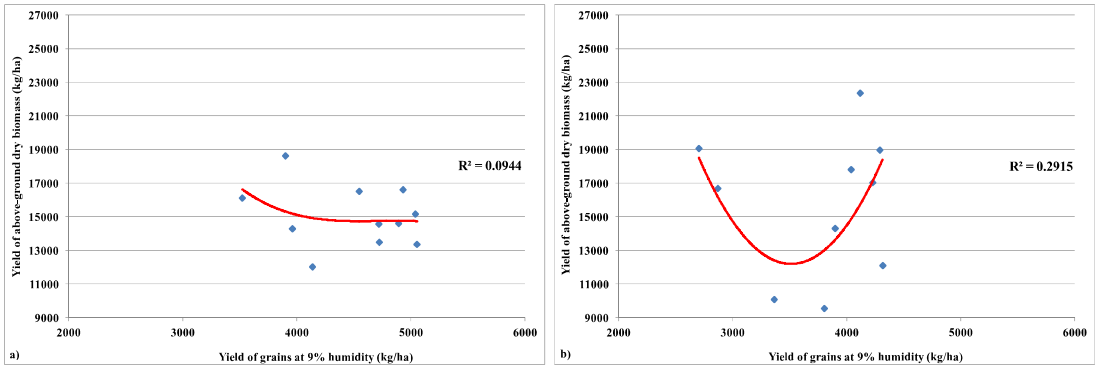



*Climatic conditions of 2013 (a- chernozem soil; b- reddish preluvosoil)*

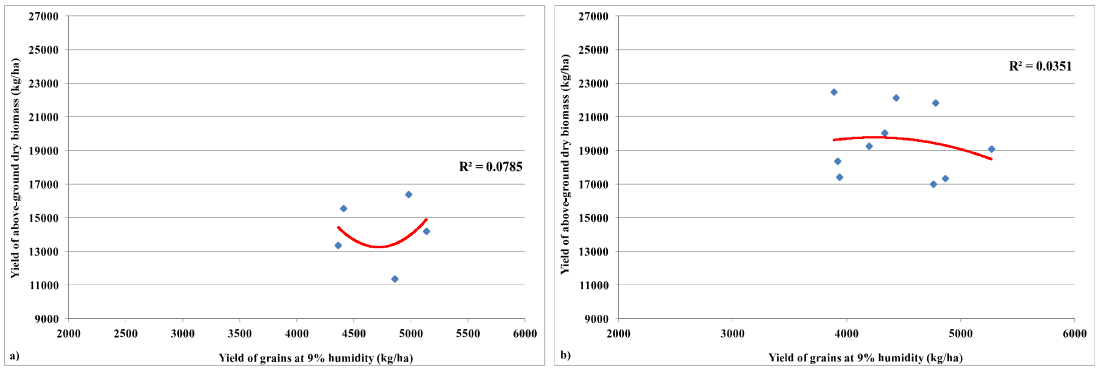



*Climatic conditions of 2014 (a- chernozem soil; b- reddish preluvosoil)*

Figure 5. Correlations of the yield of grains with the yield of above-ground dry biomass at sunflower at plant density of 60,000 plants.ha$^{-1}$, under different climatic and soil conditions




*Climatic conditions of 2013 (a- chernozem soil; b- reddish preluvosoil)*




*Climatic conditions of 2014 (a- chernozem soil; b- reddish preluvosoil)*

Figure 6. Correlations of the yield of grains with the yield of above-ground dry biomass at sunflower at plant density of 70,000 plants.ha$^{-1}$, under different climatic and soil conditions

## CONCLUSIONS

Under the climatic conditions of 2013 and 2014 and in the two locations from South Romania with different soil conditions, the grain yield did not correlated very well with the yield of above-ground biomass, whatever was the row spacing and plant density. However, there are some differences according to row spacing and plant density. Generally, the grain yield correlated negatively with the yield of above-ground biomass, except the situations registered at narrow rows under less favorable climatic conditions, especially when these were associated with less favorable soil conditions, situations when the grain yield correlated positively with the yield of above-ground biomass.

## ACKNOWLEDGEMENTS

Researches carried out for the elaboration of the present paper were financed by Romanian Program “Partnerships for Priority Domains”, project PN-II-PT-PCCA-2011-3.2-1778 “OPTImization of BIOMass and Approach to Water conservation” (OPTIBIOMA-W), Contract no. 45/2012.

**LITERATURE**

Basa, A.Gh., Ion, V., Dumbrava, M., Temocico, G., Dicu, G., Epure, L.I., State, D. (2014). Above-ground biomass of sunflower plant under different planting patterns and growing conditions. Scientific Papers. Series A. Agronomy, Vol. LVII, p. 101-109.

Basa, A.Gh., Ion, V., Dumbrava, M., Fintineru, Al., Epure, L.I., Dicu, G., State, D. (2015). Results regarding the correlation of the yield of grains with the yield of dry matter at maize crop. Scientific Papers. Series A. Agronomy, Vol. LVIII, p. 143-148.

Fetri, M., Ghobadi, M.E., Asadian, G., Rajabi, M. (2013). Effect of sowing date on yield and yield components of sunflower (*Helianthus annus* L.). Annals of Biological Research, 4 (2): 90-93.

Gjorgjieva, B., Karov, I., Mitrev, S., Ruzdik, M.N., Kostadinovska, E., Kovacevik, B. (2015). Correlation and Path Analysis in Sunflower (*Helianthus annuus* L.). HELIA, 38(63): 201-210.

Ion, V., Dicu, G., Basa, A.Gh., Dumbrava, M., Temocico, G., Epure, L.I., State, D. (2015). Sunflower Yield and Yield Components under Different Sowing Conditions. Agriculture and Agricultural Science Procedia 6: 44-51.

Yasin, A.B., Singh, S. (2010). Correlation and path coefficient analyses in sunflower. Journal of Plant Breeding and Crop Science Vol. 2(5), p. 129-133.