Scientific Papers. Series A. Agronomy, Vol. LVIII, 2015
ISSN 2285-5785; ISSN CD-ROM 2285-5793; ISSN Online 2285-5807; ISSN-L 2285-5785

RESULTS REGARDING THE CORRELATION OF THE YIELD OF GRAINS WITH THE YIELD OF DRY MATTER AT MAIZE CROP

Adrian Gheorghe BĂŞA[1], Viorel ION[1], Marin DUMBRAVĂ[1], Alexandru FÎNTÎNERU[1], Lenuța Iuliana EPURE[1], Georgeta DICU[2], Daniel STATE[2]

[1]University of Agronomic Sciences and Veterinary Medicine of Bucharest,
59 Marasti Blvd, 011464, Bucarest-1, Romania
[2]SC Procera Agrochemicals Romania SRL,
47 Muncii Street, 915200, Fundulea, Calarasi, Romania

Corresponding author email: adibasa@agro-bucuresti.ro

Abstract

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. But, the influence of different growing factors affects this correlation. In this respect, the aim of the paper was to present the results we have obtained at maize in South Romania at different hybrids and under different growing conditions (different environmental and technological conditions) regarding the correlation of the yield of grains with the yield of dry matter. In view to achieve this aim, field experiments were performed in 2012 and in 2013 in different locations from South Romania. In 2012, ten maize hybrids were studied in four locations, while in 2013 five maize hybrids were studied in two locations, which represented different soil and climatic conditions. Moreover, in 2013 each studied hybrid was studied under three row spacing (75 cm, 50 cm, and twin-rows of 75/45 cm) and three plant densities (60,000, 70,000, and 80,000 plants ha^{-1}). Under climatic conditions of 2012 and in different locations from South Romania, the yield of grains of the studied maize hybrids correlated positively with the yield of dry matter. At different row spacing and plant populations, the yield of grains correlated differently with the yield of dry matter according to growing conditions.

Key words: *maize, yield, grains, dry matter, growing conditions.*

INTRODUCTION

Maize (*Zea mays* L.) is a plant with a high grain yield potential. The yielding capacity of maize plant is determined by the yield components, which are those components that are participating to the yield formation (Ion et al., 2013). The yielding components are supposed to be dependent up to certain level by the biomass of maize plant. At its turn, the biomass of maize plant is depending on a sum of growth factors among which the cultivated hybrid, plant population, row spacing and soil conditions have a significant influence on the accumulation of the above-ground biomass and its repartition between plant components (Ion et al., 2014).

There are authors who found that biological yield is the most influential factor affecting grain yield of maize cultivars, and as a consequence the high yielding cultivars of maize can only be achieved by increasing plant biomass (Ghassemi-Golezani and Tajbakhsh, 2012). Hybrid, population density and row spacing interact to influence whole-plant yield (Baron et al., 2006). Row spacing and plant density were found to have a site specific influence (Baloyi, 2013). Researches on twin rows planting configurations are still new and needs further evaluation (Gozubenli et al., 2004).

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. But, the influence of different growing factors affects this correlation.

The aim of the paper was to present the results we have obtained at maize in South Romania at different hybrids and under different growing conditions (different environmental and technological conditions) regarding the correlation of the yield of grains with the yield of dry matter.

MATERIALS AND METHODS

Researches were performed in field experiments in 2012 and in 2013 in different locations from South Romania, which represented different soil and climatic conditions.

In 2012, researches were performed in field experiments with ten maize hybrids, respectively: CERA 270 (FAO group 270), CERA 290 (FAO group 290), CERA 370 (FAO group 370), CERA 390 (FAO group 390), CERA 6 (FAO group 390), CERA 420 (FAO group 420), CERA 2504 (FAO group 440), CERA 4505 (FAO group 450), Baragan 48 (FAO group 480), and CERA 10 (FAO group 540).

The maize hybrids were studied in four locations from South Romania, respectively: Fundulea, Calarasi County; Valcelele, Calarasi County; Visani, Braila County; Posta Calnau, Buzau County.

The year 2012 could be characterized as warm and dry, with temperatures higher than multiannual averages, especially in April and August, and with rainfalls less than multiannual averages in summer months, especially in July (only 2 mm, which means about 70 mm deficit).

The plant density was in average for the ten studied hybrids of 66,000 plants ha^{-1} at Fundulea, 62,600 plants ha^{-1} at Valcelele, 63,400 plants ha^{-1} at Visani, and 62,800 plants ha^{-1} at Posta Calnau.

In each location and for each maize hybrid, two plants in four replications (in total eight plants) were cut at soil level and they were analysed for establishing the yield of grains and the yield of dry matter. The dry matter was determined by oven drying the plants 24 hours at a temperature of $80^{o}C$.

In 2013, researches were performed in field experiments with five maize hybrids, respectively: Cera 440 (FAO group 440), Flanker (FAO group 450), ES Feria (FAO group 550), PR35T36 (FAO group 500), and Cera 540 (FAO group 540).

The maize hybrids were studied in two locations, respectively: Fundulea from Calarasi County and Moara Domneasca from Ilfov County.

Each hybrid was studied under three row spacing (75 cm, 50 cm, and twin-rows of 75/45 cm) and three plant densities (60,000, 70,000, and 80,000 plants ha^{-1}).

In each location and from each variant the maize plants from one square meter were cut at soil level and were weighed immediately. The ears were collected and analysed in view to be determined the yield of grains. One maize plant for each variant was taken into the laboratory, where it was determined the dry biomass by oven drying at $80^{o}C$ for 24 hours, as to be determined the yield of dry matter.

In both experimental years, the determinations were performed at fully ripe stage. The yield of grains was calculated in $kg.ha^{-1}$ at moisture content of 14%. The yield of dry matter was calculated in $kg.ha^{-1}$ and represents in fact the yield of above-ground biomass.

RESULTS AND DISCUSSIONS

Under climatic conditions of 2012, the yield of grains of 10 maize hybrids correlated positively with the yield of dry matter (expressed as above-ground dry biomass) at maize crop in different locations from South Romania (Figure 1). This means the highest yields of grains were registered at the highest yields of dry matter.

Under climatic conditions of 2013 and at 75 cm between rows, the yield of grains did not correlated very well with the yield of dry matter compared to the situation registered in 2012 (Figure 2). Moreover, in Fundulea location characterised by better growing conditions the yield of grains correlated positively with the yield of dry matter, while in Moara Domneasca location characterised by not so good growing conditions and even by drought in 2013, the yield of grains correlated negatively with the yield of dry matter. That means that when the growing conditions are less favourable the plant density should be lower, which means less dry matter yield. Also, under less favourable growing conditions there were register a wider variation of the data.

Under climatic conditions of 2013, as in the case of the row spacing of 75 cm, the yield of grains correlated positively with the dry matter at row spacing of 50 cm (Figure 3.a) and twin-rows of 75/45 cm (Figure 4.a), but only in

Fundulea location characterised by better growing conditions. In exchange, in Moara Domneasca location, respectively under less favourable growing conditions, at 50 cm between rows the yield of grains correlated negatively with the dry matter up to a point and after that the correlation became positive (Figure 3.b). At twin-rows of 75/45 cm and in Moara Domneasca location, on the contrary the yield of grains correlated positively with the dry matter up to a point and after that the correlation became negative (Figure 4.b).

At different plant densities, the yield of grains correlated positively with the dry matter in Fundulea location, the best correlation being registered at plant density of 70,000 plants.ha^{-1} while the worst correlation being registered at plant density of 80,000 plants.ha^{-1} (Figures 5.a, 6.a, 7.a). Also, at plant density of 70,000 plants.ha^{-1} there was registered the smallest dispersion of data.

In Moara Domneasca location, with less favourable growing conditions, the yield of grains correlated negatively with the dry matter at least up a certain point, especially at 50,000 and 80,000 plants.ha^{-1} (Figures 5.b, 6.b, 7.b).

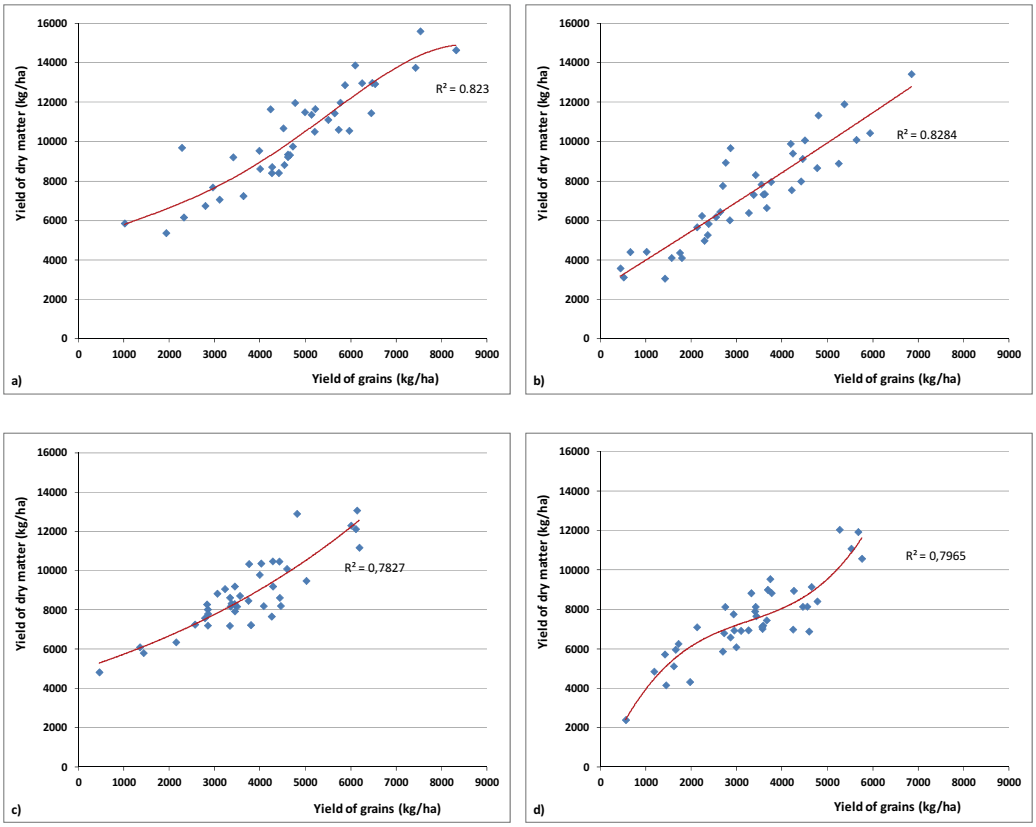

Figure 1. Correlation of the yield of grains with the yield of dry matter at maize crop in different locations from South Romania and under climatic conditions of 2012

(a- Fundulea, Calarasi County; b- Posta Calnau, Buzau County;c- Visani, Braila County; Valcelele, Calarasi County)

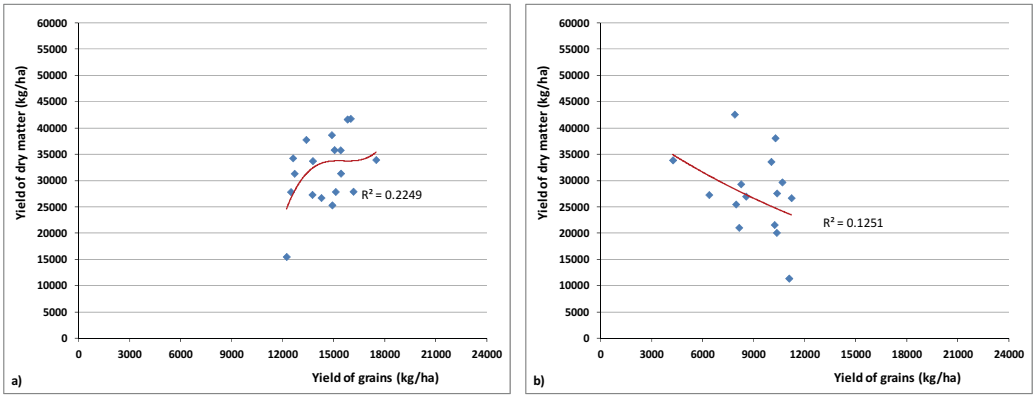

Figure 2. Correlation of the yield of grains with the yield of dry matter at maize crop at row spacing of 75 cm and under climatic conditions of 2013 (*a- Fundulea, Calarasi County; b- Moara Domneasca, Ilfov County)*

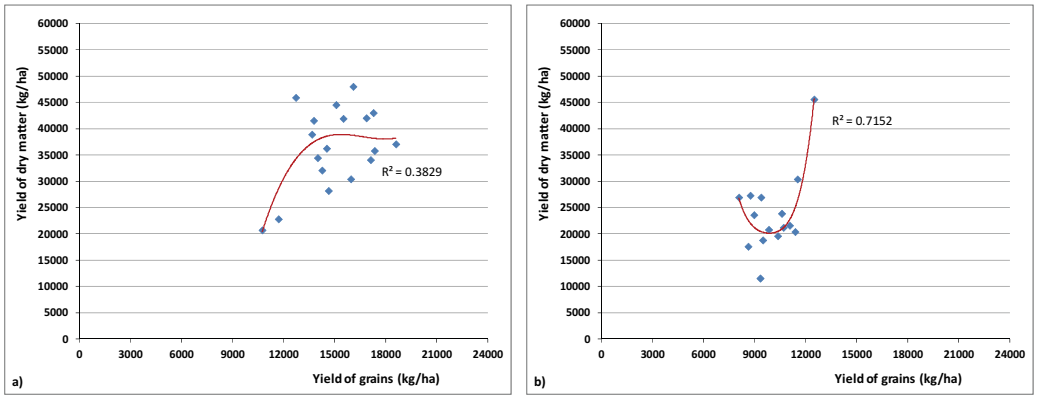

Figure 3. Correlation of the yield of grains with the yield of dry matter at maize crop at row spacing of 50 cm and under climatic conditions of 2013 (*a- Fundulea, Calarasi County; b- Moara Domneasca, Ilfov County)*

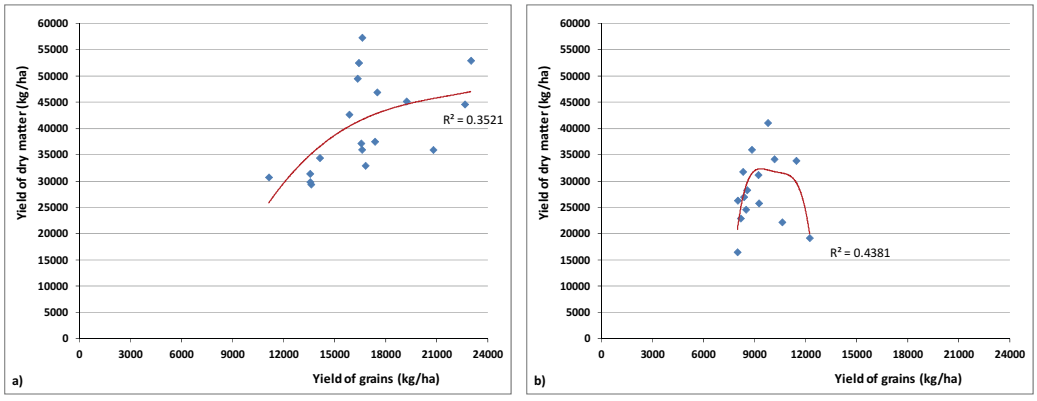

Figure 4. Correlation of the yield of grains with the yield of dry matter at maize crop at twin-rows of 75/45 cm and under climatic conditions of 2013 (*a- Fundulea, Calarasi County; b- Moara Domneasca, Ilfov County)*

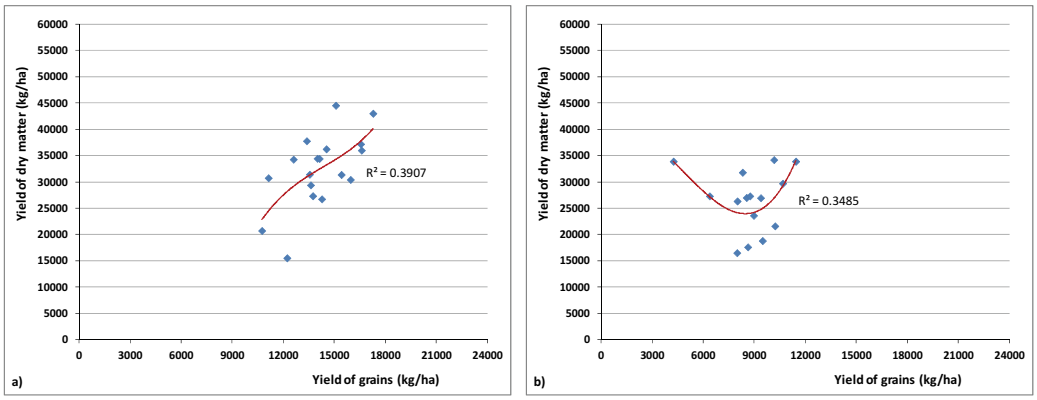

Figure 5. Correlation of the yield of grains with the yield of dry matter at maize crop at plant density of 60,000 plants/ha and under climatic conditions of 2013 (*a- Fundulea, Calarasi County; b- Moara Domneasca, Ilfov County)*

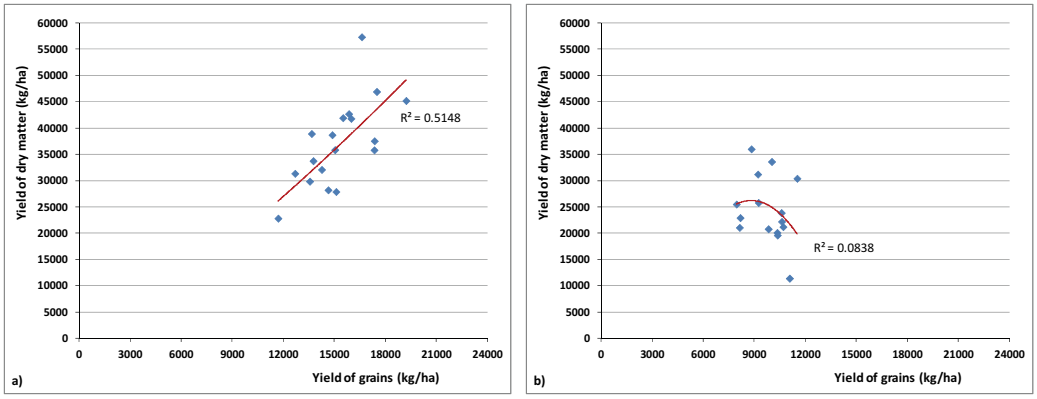

Figure 6. Correlation of the yield of grains with the yield of dry matter at maize crop at plant density of 70,000 plants/ha and under climatic conditions of 2013 (*a- Fundulea, Calarasi County; b- Moara Domneasca, Ilfov County)*

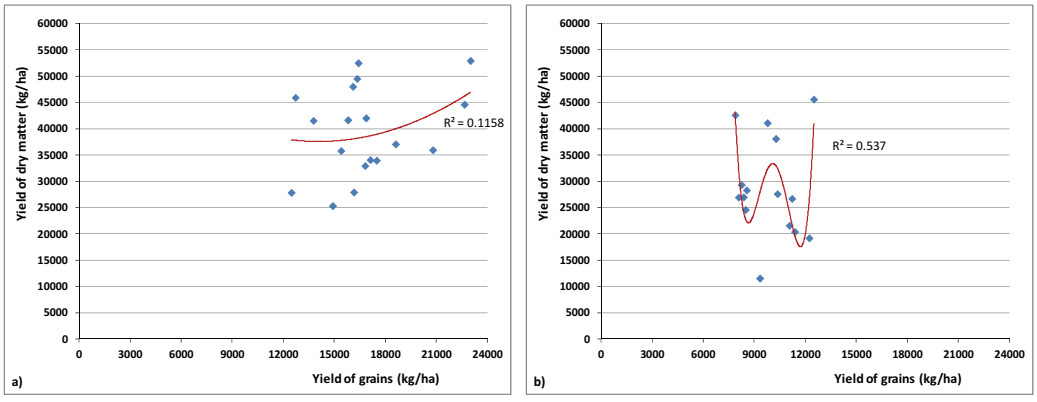

Figure 7. Correlation of the yield of grains with the yield of dry matter at maize crop at plant density of 80,000 plants/ha and under climatic conditions of 2013 (*a- Fundulea, Calarasi County; b- Moara Domneasca, Ilfov County)*

CONCLUSIONS

Under climatic conditions of 2012 and in different locations from South Romania, the yield of grains of the studied maize hybrids correlated positively with the yield of dry matter (above-ground dry matter).

At different row spacing, the yield of grains correlated differently with the yield of dry matter according to growing conditions. Thus, under favourable growing conditions at different row spacing, the yield of grains correlated positively with the yield of dry matter, while under less favourable growing conditions the tendency was the yield of grains to correlate negatively with the yield of dry matter.

Also at different plant densities, the yield of grains correlated differently with the yield of dry matter according to growing conditions. Thus, under favourable growing conditions at different plant densities, the yield of grains correlated positively with the yield of dry matter, while under less favourable growing conditions the tendency was the yield of grains to correlate negatively with the yield of dry matter.

ACKNOWLEDGEMENTS

The 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.

REFERENCES

Baloyi T.C., 2013. Maize grain yield response to variance in plant density under minimal soil disturbance and row spacing. Agricultural Science Research Journals Vol. 3(8): 250-260.

Baron V.S., Najda H.G., Stevenson F.C., 2006. Influence of population density, row spacing and hybrid on forage corn yield and nutritive value in a cool-season environment. Canadian Journal of Plant Science, 86: 1131-1138.

Ghassemi-Golezani K., Tajbakhsh Z., 2012. Relationship of plant biomass and grain filling with grain yield of maize cultivars. International Journal of Agriculture and Crop Sciences, Vol. 4 (20): 1536-1539.

Gozubenli H., Kilink M., Sener O., Konuskan O., 2004. Effects of single and twin row planting on yield and yield components in maize. Asian Journal of Plant Scinces, 3 (2): 203-206.

Ion V., Dicu G., State D., Fintineru G., Epure L.I., Basa A.G., Toader M., 2013. Yield components of different hybrids of maize (*Zea mays* L.) cultivated in South Romania under drought conditions. Scientific Papers. Series A. Agonomy, Vol. LVI, p. 276-283.

Ion V., Băşa A.Gh., Temocico G., Dicu G., Epure L.I., State D., 2014. Maize plant biomass at different hybrids, plant populations, row spacing and soil conditions. Romanian Biotechnological Letters, Vol. 19, No 4, p. 9551-9560.