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# ECOLOGY ISSUES OF SOYBEAN CROP PLANTS

**Nicolae IONESCU[1], Aurelian PENESCU[2], Pompiliu CHIRILĂ[3]**

[1]Agricultural Research and Development Station Pitesti, Pitesti-Slatina Road no. 5, 117030, Pitesti, Romania, Phone: 0372753083, Fax: 0248206334, Email: nicolaeionescu50@gmail.com
[2]University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti Blvd, 011464, Bucharest, Romania, Email: a_penescu@yahoo.com
[3]National Agricultural Research and Development Institute Fundulea, N. Titulescu Road no. 1, 915200 Fundulea, Romania, Phone: 0372.715.839, Fax: 0242.642.875, Email: chirilapompiliu@yahoo.com

Corresponding author email: nicolaeionescu50@gmail.com

***Abstract***

*Being a plant with considerable agronomic qualities, soybean returns to farmers attention (Dencescu et al.,1982b; Ionescu, 1985). Indeed the new varieties have improved by characters: high production potential, quality and constantly over time (Gallais & Bennerot, 1992). In exchange for use of these qualities are needed informations about how to adapt plants in different ecological areas (Giosan et al., 1986). Given white luvicsoil in South the plant finds a good regime of sufficient rainfall and temperature (Ionescu et al., 1986; 1994). Against this background proved to be important the specific crop system. 2.0-3.0 t.ha$^{-1}$ yields were obtained while during the filling of the grains fell 150-200 mm water. During the growing season of 100-140 days have accumulated 1200-1400$^0$C temperatures above 10$^0$C. Among during the growing season and grain production achieved a positive correlation (r=0.591***) so that varieties with higher period during the growing season formed the best production. Plant morphology: size, number of pods per plant and grains were positively correlated with grain yield. Negative correlations were obtained between the thousand grains weight-TGW with production of grains, TGW with grain number per plant and between fat content with the content of crude protein of the grain. Production levels achieved over the years has been between 1.06 and 3.49 t.ha$^{-1}$ like limits. Among the crop items highlighted technological density peaks at 60-80 seeds.sq.m$^{-1}$.*

***Key words****: ecology, morphology, quality, soybean plants, albic luvisol.*

## INTRODUCTION

Due to its importance (Bîlteanu & Bîrnaure, 1989), soybean [*Glycine max* (L) Merrill, *G. hispida* (Moench) Max a.s.o] is required increasingly more so in the world (Cregan, 2008), and us (David, 2002). To obtain high yields of grains is recommended primarily cultivation of new varieties adapted (Haş, 2006). These new varieties are accepted under the rules of priority established specific eco-system (Ionescu & Ionescu, 2012). In one such eco-soy system will not miss sustainability, environmental protection and the cultivation technological links as such. Thus, each ecological zone of soybean eco-system adapts its own rules after. The aim is that the new variety to produce as much grain, both quantitatively and qualitatively.

Given soybean genetics (Dencescu, 1980; 1982a; Cregan, 2008), obtaining maximum production of soy beans in a variety is based on a real complex characters. Some of these characters is based on the additive gene action, such as: the number of seeds per plant, grain size and height (size) of the plant. Other characters besides the additive action, is also based on dominance and epistasis of genes, for example: the number of nodes per plant, number of pods per plant and the number of beans in the pod (David, 2002). The quality of soybeans is expressed mainly through the protein and fat content. Along with the production of grain, the two characters have a wider complexity of both the structure and the respective genetic factors (Wilcox & Shibles, 2001; Yin & Vyn, 2005). Meanwhile, grain yield and quality varieties and new lines are greatly influenced by environmental factors.

Expressing characteristics of soybean adaptability to eco-culture medium can be done through the study of correlations (Yin & Vyn,

2005). Some ie between content of proteins, the fat and morphological characters of soybean were positive. However, correlations between proteins and fats found in most grains varieties were negative (Wilcox & Shibles, 2001; Ifrim & Haş, 2008).
In this paper we present the adaptation aspects of soybean plants through the correlations in several directions. The first direction refers to grain yield response to climatic factors: rainfall and temperatures assets. Another line shows the connection between morphological elements: size, number of nodes on the stem, number of pods per plant and number of grains per plant, on grain yield formation. A third line shows the correlations between absolute grain weight (TGW) with grain yield, number of grains per plant, and between the fat content with protein. Grain yield obtained over the years has highlighted the influence of year and density, as two elements which best expresses the ecology of some new soybean varieties and lines.

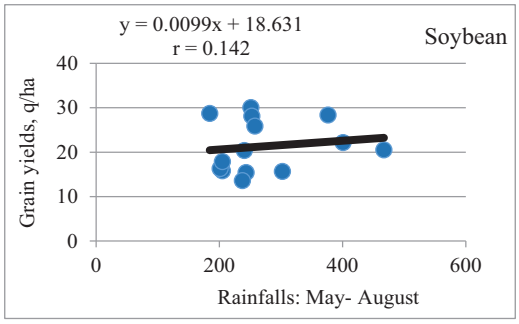
## MATERIALS AND METHODS

Soybean grown to normal after the technology developed by the resort. We used a relatively long period of time, lines and new varieties recommended for areas that belong white luvic-soils of southern territory. The data represent the average periods of research. Measurements and determinations were made both in the field (Photo 1) and laboratory follow several parameters.
During the vegetation period (VP) of soy, precipitations were noted in two periods and namely the entire period between sunrise and maturity, and during the submission of the reserve substances period (July and August). Temperatures active: $\Sigma tn^0$ $C>10^0C$ were accumulated throughout the growing season, as well as the number of vegetation days.
Soybean plants were measured: size from the crop, the number of nodes on the main stem, number of pods on the whole plant, grain number per plant, and grain from production area. Experiences with lines and new varieties were made after the block method in five repetitions and variants had each 25 $m^2$. In experiments with the density method was all the blocks in 5 replications, with 20, 40, 60, 80, and 100 grains/$m^2$, 25 $m^2$ each variants.
Soybean were determined: thousand grains weight (TGW), the average number per plant, the fat content and protein content.
Between the different measurements and determinations settled most important correlations.

Photo 1. Daciana variety (0)(David, 2006)

## RESULTS AND DISCUSSIONS

**On the climate**. Soy is generally high demands for water and warm. From the beginning, soybeans need water for germination of 150% of their dry weight. The specific consumption is expressed by the transpiration coefficient between 300 and 700. Sweating period for water occurs during the formation of reproductive organs, flowering and grain filling.
The correlations obtained between the amount of rain fallen, so the entire growing season and in the months of July- August shows positive upper results (Figure 1). If the entire growing season, the correlation coefficient was pasitive, but not significant (r=0.142), one from July to August was significant (r=0.695*). The chart shows that the rains have fallen throughout the soybean growing season were between 180 and 480 mm, while the July-August were between 50 and 220 mm.
Compared to soy light behaves as a short-day plant, so that integration as early seeding ensures claims for medium varieties photoperiod district here. Warm factor recorded in vegetation soybean varieties was between 1200-1400$^0$C ($\Sigma tn^0$ $C>10^0C$).
Correlations between vegetation period (in days) with $\Sigma tn^0C>10^0C$ and between vegetation period with grain yield were positive and highly secured statistic (Figure 2). Thus, during the growing season of 95 to 140 days were cumulative 1200-1400 $\Sigma tn^0$ $C>10^0C$ and average yields were between 22 and 28 q/ha (according to the regression line).



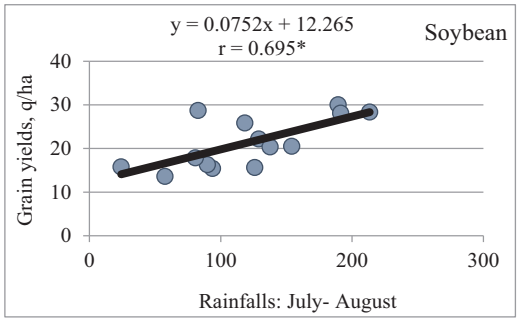
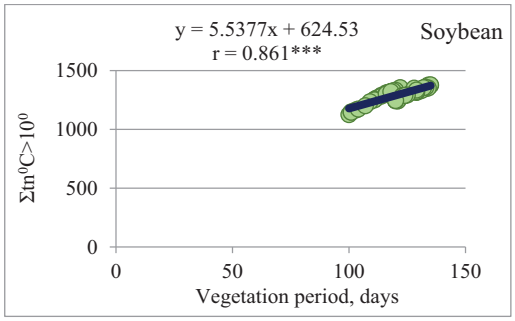




Figure 1. Correlation between rainfalls sum (two periods) and soybean grain yields



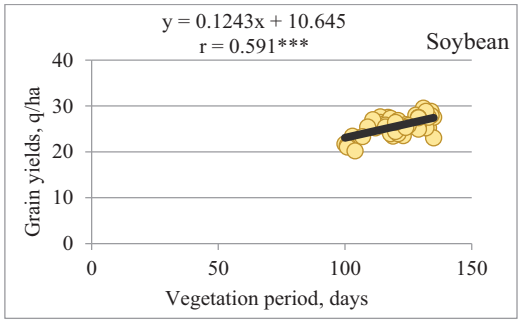
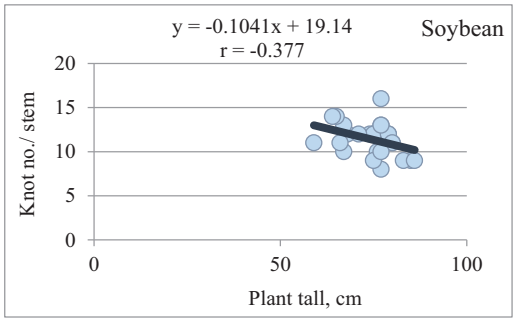




Figure 2. Correlations between vegetation period (VP) with active temperatures sum ($\Sigma tn>10^0C$) (left) and VP with soybean grain yields

**Characteristics of soybean plant.** The correlation between plant height obtained with the number of nodes on the main stem was negative (r=-0.377). This means that varieties and lines formed more pods and beans at fewer nodes. Plants 60-90 cm high were formed between 13 and 10 knots. The correlation between plant tall with grain production is positive, slightly increasing and no significant (r=0.205) (Figure 3). The data show that the plants were between 60-80 cm tall and produced between 24 and 28 q/ha grain.



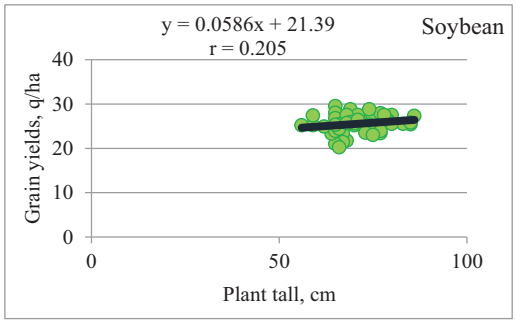
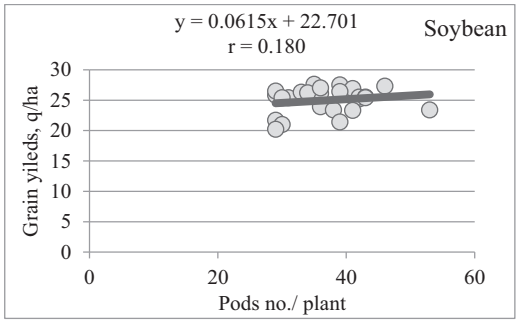




Figure 3. Correlations between plant size (tall) and knot number per stem (left) and plant size (tall) with soybean grain yields



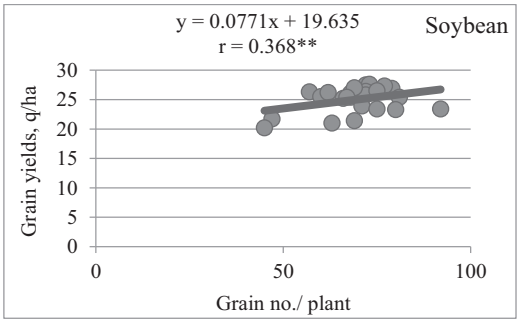



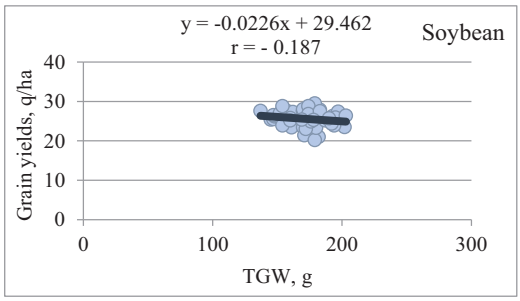

Figure 4. Correlations between pods no. per plant with grains yields (left) and grains no. per plant with soybean grain yields

Other characteristics: the number of soybean pods per plant and the number of grains per plant were positively correlated with the grain productions (Figure 4). The data showed that 25-46 pods per plant resulted in the formation of about 25 q/ha grain, with r=0.180. The number of grains of between 40-90 on a soybean plant ensured production of 23-27 q/ha, with r=0.368** (insured statistic). By comparing the two characters showed that the number of grains formed on a soybean plant was decisive in the formation of higher production.

**Characteristics of soybean grain.** The correlations obtained between the thousand grains weight (TGW) with production of grain and between the number of grains per soy plant and TGW were negative (r=-0.187, and r=-0.363 respectively, Figure 5).

Between beans fat content and protein content was obtained a negative correlation, with r=-0.833***.

Data show that crude fat varied between 16% and 19%, and crude protein between 45% and 36% (Figure 6 and Photo 2).



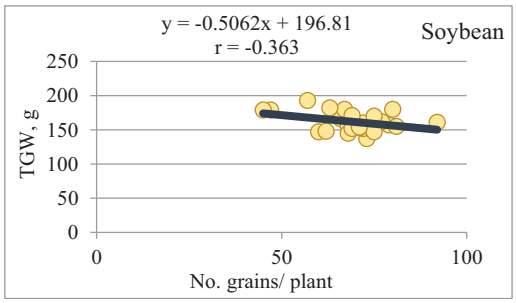




Figure 5. Correlations between TGW with grain yields (left) and between grain number/ plant and TGW

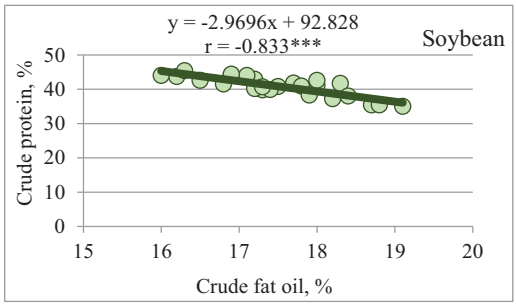



Figure 6. Correlation between fat oil and protein contents from soybean grain

Photo 2. Daciana grains

**Soybean grain yield.** Production levels achieved over the years were located at different levels. Greatest influence was the year of culture (Table 1). In new soybean varieties (Daciana also) and lines were markedly different. Absolute values of soybean yields were 30.1-34.9 q/ha like maximum, and 10.6-11.8 q/ha like minimum. Among the technological elements of soybean crop, density plays an important role. The high yields obtained over time were obtained from 60 to 80 grains/$m^2$ (Table 2).

## CONCLUSIONS

Rainfall that fell in soybean vegetation were between 200 and 500 mm, and in July- August period of 40 to 220 mm. However, production levels were 15-30 q/ha, as it has contributed to the formation of cross-system practiced. The amount of active degrees of temperature (>$10^0$C) was between 1200-1400$^0$C, which allows the cultivation of early varieties (000, 00) and middle (0). The growing season was 95- 140 days. Higher production was achieved with more grains per plant, followed by higher tall and a greater number of pods per plant. In contrast, the tall (high) plants are knots less. Negative correlations were obtained between the TGW and production, the number of grains on a plant and TGW, and between grains fats and proteins.

Average grain yields were obviously influenced by climatic conditions. The levels of

more than 30 q/ha were obtained for 5 years, 11-18 q/ha were in 3 years, and the following years were intermediate. Between technological measures, 80 grains/m$^2$ density ensured 2/3 of years in the achievement of great productions.

Table 1. The grain yileds of differing soybean varieties and lines, q.ha$^{-1}$

| Var./years | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $A_1$ | 15.7 | **30.1** | 29.7 | 17.5 | 28.6 | 23.0 | 28.9 | **30.6** | 13.8 | 13.0 | 13.0 | 16.7 | 16.5 | 19.1 |
| $A_2$ | 18.7 | 23.3 | 25.0 | 18.3 | 27.1 | 20.8 | 24.8 | 29.9 | 15.3 | 16.0 | 13.8 | 19.5 | 16.8 | 17.5 |
| $A_3$ | 15.3 | 26.5 | 22.5 | 22.9 | **30.2** | 16.4 | 20.6 | 28.0 | 15.3 | 14.6 | 15.0 | 19.9 | 15.8 | 14.9 |
| $A_4$ | 14.4 | 27.9 | 19.4 | 22.4 | 27.3 | 22.2 | 27.9 | 28.3 | 17.7 | 14.9 | 13.5 | 15.5 | 15.8 | 16.3 |
| $A_5$ | 16.1 | **34.0** | 28.9 | 29.9 | 27.9 | 21.4 | 28.6 | **30.7** | 16.0 | 18.0 | 14.3 | 19.9 | 17.0 | 14.2 |
| $A_6$ | 17.0 | 25.9 | 29.1 | 22.8 | **30.7** | 22.1 | **30.1** | **30.5** | 15.2 | 14.8 | 15.3 | 18.7 | 20.0 | 18.6 |
| $A_7$ | 13.8 | **32.3** | 29.8 | 24.4 | 29.4 | 20.9 | 25.6 | 29.7 | 14.0 | 14.9 | 14.8 | 20.7 | 18.3 | 17.5 |
| $A_8$ | 16.8 | 29.2 | 23.6 | 21.2 | **30.9** | 23.3 | 28.8 | 26.9 | 16.5 | 17.8 | 15.3 | 16.4 | 15.8 | 18.8 |
| $A_9$ | 18.1 | 29.1 | 26.7 | 21.8 | 28.4 | 22.5 | 26.1 | **30.7** | 12.1 | 16.6 | 16.5 | 20.6 | 14.3 | 18.1 |
| $A_{10}$ | **10.6** | 27.5 | **33.8** | 25.3 | 29.4 | 21.2 | 25.8 | 29.6 | **10.9** | 14.2 | 13.5 | 18.5 | 17.8 | 17.6 |
| $A_{11}$ | 11.4 | 27.0 | **30.2** | 18.0 | 29.1 | 21.9 | 25.8 | **31.1** | 15.9 | 14.1 | 13.3 | 19.1 | 14.4 | 19.9 |
| $A_{12}$ | 20.5 | **32.9** | **31.3** | 24.7 | 26.6 | 21.1 | **31.5** | 29.4 | 17.4 | 13.7 | 16.0 | 19.3 | 14.3 | 17.3 |
| $A_{13}$ | 13.5 | **30.5** | **32.8** | 21.5 | 29.6 | 21.9 | 26.5 | 28.0 | 17.6 | 15.5 | 14.8 | 19.2 | 16.3 | 14.5 |
| $A_{14}$ | 16.9 | **30.5** | **31.5** | 25.4 | 29.4 | 21.5 | 27.7 | 28.1 | 14.6 | 14.6 | 13.0 | 20.3 | 17.0 | 19.2 |
| $A_{15}$ | 16.9 | 26.0 | 28.4 | 22.7 | 29.4 | 21.4 | 26.2 | **31.9** | 17.0 | 16.1 | 14.5 | 20.2 | 15.0 | 16.6 |
| $A_{16}$ | 15.8 | **32.4** | 25.7 | 21.8 | 27.1 | 22.9 | 26.6 | **31.6** | 17.6 | 13.6 | 11.8 | 18.8 | 15.8 | 20.1 |
| $A_{17}$ | 10.7 | **34.9** | 23.6 | 19.4 | 28.6 | 22.7 | 25.0 | 28.5 | 16.1 | 18.4 | 12.8 | 17.8 | 15.3 | 16.2 |
| $A_{18}$ | 15.0 | **33.1** | **30.1** | 22.7 | 29.6 | 21.7 | 26.3 | 28.2 | 16.1 | 16.6 | 11.8 | 21.9 | 14.3 | 14.7 |
| $A_{19}$ | 17.0 | **31.6** | 29.2 | 19.2 | 27.9 | 19.8 | 23.9 | 26.5 | 15.3 | 15.9 | 11.3 | 19.6 | 15.3 | 18.2 |
| $A_{20}$ | 19.9 | **31.9** | 27.0 | 25.7 | 29.6 | 21.0 | 23.6 | 27.1 | 18.4 | 14.1 | 11.5 | 17.1 | 17.5 | 18.6 |
| $A_{21}$ | 13.2 | **31.2** | 29.9 | 17.6 | 25.8 | 15.6 | 28.0 | 26.5 | 16.1 | 12.3 | 13.0 | 22.7 | 18.0 | 19.9 |
| $A_{22}$ | 18.6 | 27.0 | 29.2 | 23.7 | 24.8 | 15.3 | 20.6 | 28.2 | 14.9 | 14.8 | 13.8 | 20.7 | 14.8 | 18.8 |
| $A_{23}$ | **10.8** | **31.6** | 29.9 | 21.4 | 25.8 | 16.4 | 20.1 | 26.6 | 17.0 | 17.9 | 12.8 | 19.1 | 17.8 | 20.2 |
| $A_{24}$ | 16.3 | **32.0** | 25.5 | 21.2 | 29.1 | 16.4 | 21.8 | 22.4 | 17.0 | 15.3 | 11.8 | 18.7 | 16.3 | 19.6 |
| $A_{25}$ | 18.1 | **32.0** | 29.8 | 22.6 | 26.8 | 15.7 | 25.4 | 28.7 | 17.2 | 17.7 | 12.8 | 18.0 | 17.3 | 20.0 |
| *DL 5%* | *2.41* | *2.97* | *5.75* | *1.71* | *1.55* | *4.12* | *3.17* | *2.22* | *3.33* | *3.46* | *2.96* | *4.44* | *2.37* | *3.35* |
| *DL 1%* | *3.22* | *4.03* | *7.81* | *2.32* | *2.09* | *5.47* | *4.19* | *2.95* | *4.44* | *4.59* | *3.93* | *5.89* | *3.22* | *4.47* |
| *DL 0.1%* | *4.20* | *5.40* | *10.46* | *3.11* | *2.80* | *7.05* | *5.39* | *3.80* | *5.79* | *5.91* | *5.07* | *7.61* | *4.31* | *5.84* |
| MEDIA | **15.6** | **30.0** | **28.1** | **22.2** | **28.4** | **20.4** | **25.9** | **28.7** | **15.8** | **15.4** | **13.6** | **20.5** | **16.3** | **17.9** |

Table 2. The density influence on soybean grain yields

| Var./years | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 | 10.9 | 22.2 | 15.1 | 10.4 | 16.0 | 10.3 | 14.2 | 14.1 | 28.0 | 11.3 | 11.2 | 23.8 |
| 40 | 17.7 | 25.0 | **17.9** | 13.6 | 18.0 | 11.5 | 16.3 | 14.2 | 30.0 | 12.7 | 13.2 | **26.8** |
| 60 | 18.3 | 26.9 | 17.3 | 14.0 | **18.8** | 13.8 | **19.1** | 17.0 | 30.5 | 13.2 | 14.7 | 25.2 |
| 80 | **20.8** | **27.8** | 15.5 | **14.4** | 18.7 | **15.3** | 17.1 | **18.9** | **31.0** | **14.8** | **15.5** | 24.4 |
| 100 | 18.6 | 25.1 | 15.3 | 14.1 | 17.2 | 14.9 | 16.0 | 16.6 | 29.3 | 11.6 | 13.8 | 24.0 |
| *DL 5 %* | *4.01* | *5.82* | *2.75* | *1.87* | *4.97* | *3.77* | *3.93* | *2.64* | *5.60* | *3.23* | *2.30* | *3.93* |
| *DL 1 %* | *5.50* | *7.98* | *3.77* | *2.56* | *7.53* | *5.43* | *5.66* | *3.79* | *8.06* | *4.65* | *3.15* | *5.65* |
| *DL 0.1%* | *7.49* | *10.86* | *5.14* | *3.49* | *12.10* | *7.98* | *8.32* | *5.57* | *11.85* | *6.84* | *4.27* | *8.01* |
| **MEDIA** | **17.3** | **25.4** | **16.2** | **13.3** | **17.7** | **13.2** | **16.5** | **16.2** | **29.8** | **12.7** | **13.7** | **24.8** |

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