# PERFORMANCE OF WINTER RAPESEED HYBRIDS MAXIMUS® IN EUROPEAN CONTINENTAL CLIMATIC CONDITIONS

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**Abstract**

The choice of this topic was induced by the many uses of rapeseed and especially by the current worldwide preoccupations to use alternative biofuels, in contrast with conventional fuels, that nowadays are the main source of pollution. This paper presents the production results of winter rapeseed (WOSR) hybrids, belonging to the Pioneer Hi-Bred International Company (semi-tall hybrids vs. conventional hybrids), exposed to the Eastern Europe's continental climate conditions. There were selected 14 autumn rapeseed hybrids for evaluation from different locations in Romania, Hungary, Slovakia and Slovenia, during the years 2010 and 2011. During the analysis of the production capacity and oil content, there were seen differences between these two agronomic attributes, especially in terms of climate conditions. This paper also presents many advantages of growing **MAXIMUS®** rapeseed hybrids, with low levels of glucosinolate and erucic acid, from sowing to harvesting .These benefits that can be sustained by experienced farmers. The results of the conducted studies prove a great ecological plasticity and good resistance to harsh conditions experienced in the area of cultivation.

**Key words**: performance, WOSR, Maximus, European condition

Rapeseed (Brassica napus) occupies now a very important place in the world economy as a source of oil. The seeds of the new commercial hybrids have a content of oil from 48% to 51%, oil used both in alimentation and in industry.

The progress made worldwide in improving the plant and in its multiple utilization fully motivates the reconsideration of rapeseed cultivation. The results of the plant improving program, based on the **OGU-INRA CMS (**cytoplasmic male sterility) hybridization system, and the role of DELLA proteins regarding the activity of the gibberellinic hormone (GA) allowed Pioneer Hi-Bred International INC. Company to obtain semi-tall hybrids, commercially named MAXIMUS®.

The unique developing and the agronomic attributes of Maximus® hybrids, in comparison with the conventional hybrids is shown by the 5-8% additional seeds per unit area, lower vegetation treatments costs and the eased harvesting, reducing the fuel consumption and increasing the efficiency. The hybrid develops a strong root system and a fast growth even since the first stages of vegetation, entering in the winter season in the stage of 6-8 leaves, forming a well developed crop. It is easier to apply the phytosanitary treatment because of the plant's height and the frequency decreases due to better resistance to pathogens (*Sclerotinia sclerotiorum, Phoma lingam, Verticillium sp*. and *Plasmodiophora brassicae*).

Recent progresses on the improvement of production capacity and low content of glucosinolates and higher oil content have the effect of culture expansion and diversification of uses. With the discovery of genes conferring low heights to varieties of wheat and rice, marketing of semi-tall rapeseed hybrids is a part of the so-called Green Revolution.

## MATERIAL AND METHOD

From the polifactorial experience with autumn rapeseed hybrids conducted in 2010 and in 2011 in the metropolitan network of Pioneer Hi-Bred International Inc., there were selected for analysis a number of 14 type 00 hybrids, with low glucosinolate and erucic acid content(4 Maximus® hybrids and 10 conventional hybrids).

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Maximus® hybrids are 44D03, 44D04, 44D05, 44D06 and the conventional hybrids are 44W22, 44W29, 46W09, 46W10, 46W14, 46W20, 46W21, 46W24, 46W30 and 46W31.

The experiment was conducted in 61 locations in 2010 and in 2011 in 76 locations in Eastern Europe, specifically in Romania, Hungary, Slovakia and Slovenia (covering an area of 400,730 km2 and serving 39,540,000 citizens). Note that experience is part of a test program at European level called PACTS (Pioneer Crop Accurate Testing System).

The calculation and interpretation of the data was made by the model proposed by Ceapoiu N. (1986), using variance factors: hybrids, experimentation regions and years. The production and the oil content are influenced by the technology that the company uses, and the results are represented by an overall analysis under the influence of hybrid x year x region of experimentation.

## RESULTS AND DISCUSSIONS

The subject of this research is the winter rapeseed hybrid production potential in the Eastern Europe's climate and terrain conditions, during the years 2010 and 2011.

In the area experimented for two years there were grown both semi tall Maximus® and conventional hybrids. Overall, habitat conditions were similar, differing only from year to year, with a low germination the autumn of 2009 followed by a cold winter, with plenty of snow that maintained the crop's heath, without registering dangerous frosts.

The precipitations in the spring and summer of 2010 have been very high, almost double compared to a regular year. Registered losses were mainly because of the frequent rains accompanied by hail. The harvest recorded was low, the Eastern European average being 2.6 tons/acre.

The rape culture sown in the autumn of 2010 found more favorable conditions compared with the autumn of 2009. Significant areas were sown with rapeseed due to the favorable price and the increasing demand for biofuels. The winter of 2010 was mild, therefore no major losses were registered because of frosting and the crop's condition was good.

The spring rains and the high temperatures registered during summer time favored plant growing and development. During flowering and grain filling have been recorded favorable conditions for rapeseed. The average annual production in 2011 in Eastern Europe was higher than in 2010, registering a value of 3.0 to/acres. (*figure 1*)

The concerns regarding the performance of the analyzed hybrids are a major goal, so that by applying the newest knowledge, the contribution of rapeseed for oil increases annually. Therefore, we calculated the average of the two categories of hybrids during the experiment; the partially modified productions are presented in *table 1*. Variance analysis results are presented in *table 2*.

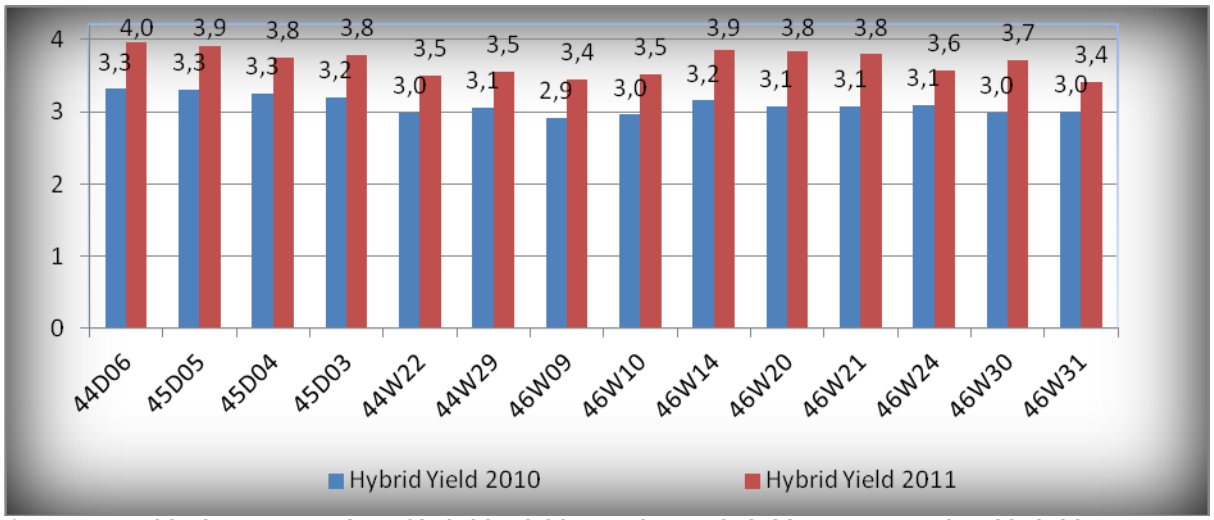


Figure 1. **Graphical representation of hybrids yields, Maximus® hybrids vs. conventional hybrids, during the testing period in Eastern European climatic conditions (tone/acre).**

Table 1

**Production of winter rapeseed hybrids in Eastern Europe (q/ha)**

| Experimentation network | Year | Hybrid type | | Sum |
|---|---|---|---|---|
| | | Maximus® | Tall | |
| Romania | 2010 *(29 loc*)* | 32 | 29 | 61 |
| | 2011 *(34 loc)* | 37 | 35 | 72 |
| *Sum* | | **69** | **64** | 133 |
| Slovenia | 2010 *(15 loc)* | 34 | 31 | 65 |
| | 2011 *(8 loc)* | 41 | 38 | 79 |
| *Sum* | | **75** | **69** | 144 |
| Slovakia | 2010 *(14 loc)* | 34 | 31 | 65 |
| | 2011 *(11 loc)* | 39 | 36 | 75 |
| *Sum* | | **73** | **67** | 140 |
| Hungary | 2010 *(3 loc)* | 32 | 29 | 61 |
| | 2011 (*23 loc*) | 37 | 35 | 72 |
| *Sum* | | **69** | **64** | 133 |
| | 2010 *(61 loc)* | 132 | 120 | 252 |
| | 2011 *(76 loc)* | 154 | 144 | 298 |
| *Sum* | | **286** | **264** | 550 |

**locations*

Table 2

**Variance analysis (ANOVA)**

| Variance source | *SPA* | *l* | $s^2$ | *F* |
|---|---|---|---|---|
| TOTAL | 188 | 15 | | |
| Hybrids | 30 | 1 | 30.00 | 100,00* |
| Experimentation networks | 22 | 3 | 7.30 | 24,30* |
| Years | 132 | 1 | 132,0 | 440,00*** |
| Hybrids x Experimentation networks | 1 | 3 | 0,33 | 1,00 |
| Hybrids x Years | 1 | 1 | 1,00 | 3,03 |
| Experimentation networks x Years | 3 | 3 | 1,00 | 3,03 |
| Remainder | -1 | -3 | 0,33 | |

Average production of autumn rapeseed hybrids and the meaning of the differences are presented in *tablet 3*. Is observed a significant difference in the production capacity of the Maximus ® hybrids reported to the two categories of analyzed hybrids, also, a significant negative difference for conventional hybrids reported to controls. Production differences are 8% for Maximus® hybrids, difference that prove a better adaptation to the weather conditions in Eastern Europe.

Based on F test, we can make the following interpretations:

1. The oscillations of hybrid production recorded significant differences. There is also a significant influence in the regions of experimentation. The mark of ecological conditions is very significant and there have been registered differences that can't be provided.
2. The interaction Hybrids x Experimental regions and Hybrids x Years are insignificant.
3. The interaction Experimental regions x Years is also insignificant, meaning that the hybrids have a high level of ecological plasticity, unaffecting the production capacity from a region to another, in the same experimental year.

Table 3

**Average Production of autumn rapeseed hybrids evaluated during 2010 and 2011 in Eastern Europe**

| Hybrid | Average seed production | | Difference |
|---|---|---|---|
| | q/acre | % | |
| Maximus® hybrids | 35.75 | 104 | 1.38* |
| Conventional hybrids | 33.00 | 96 | -1.37$^o$ |
| Control | 34.37 | 100 | |
| LSD 5% 0.89 q/acre<br>LSD1% 1.63 q/acre<br>LSD 0.1% 3.62 q/acre | | | |

The oil content can be analyzed in a graph from *figure 2* where it is represented during the two years of research.

Turning attention again to the climatic conditions of the two years, in general, we can say that 2011 was a more favorable year than the 2010 for the autumn rapeseed culture. As seen on *figure*

*2*, oil content values are relatively close, the differences being insignificant. Oil content is influenced by climatic conditions, as evidence is the greater percentage of oil that has been registered in 2011, when it was a better year for the rapeseed culture. The oil content of Maximus® hybrids is slightly over the average percentage of tall hybrids, both in 2010 and 2011.

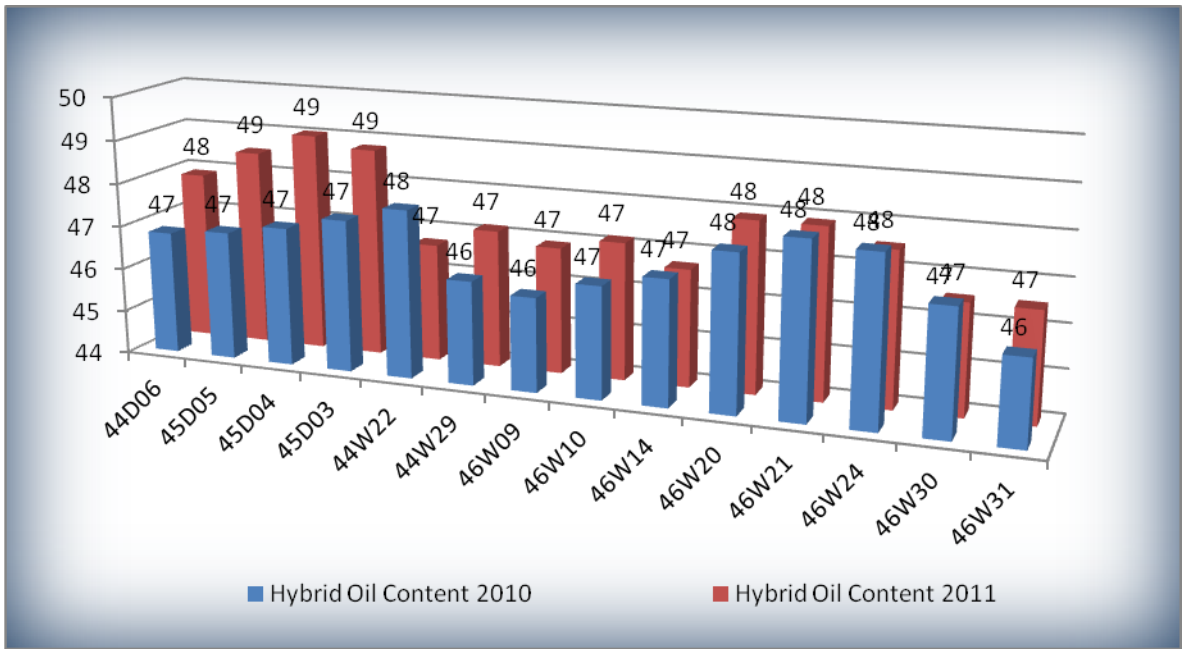


Figure 2 **Graphical representation of the oil content of Maximus® hybrids and conventional hybrids in 2010 and 2011 in Eastern Europe (%)**

Due to the large number of locations where this experience was conducted and due to the farmers, it was not possible to keep financial records and to perform economic analysis of the evaluated hybrids. However, farmers have seen a number of advantages of Maximus ® hybrids, from planting to harvesting. Recalling the International Conference on Harvesting and Processing (Louisville, Kentucky, USA) has been brought to the attention of farmers that only by taking semi tall hybrids are saving € 35 / acre compared with harvesting the same area, but cultivated with conventional hybrids.

The root system of Maximus ® hybrids do best in the early stages of vegetation, and in spring you can see fewer losses, showing good resistance to winter. The rapidly increasing growth rate since the spring makes growing semi tall hybrids a better run for the autumn cereals.

The resistance of these hybrids to the attack of pests and diseases has been proven by many farmers, growers of rapeseed, the application of phytosanitary treatment is easier because of lower plant waist, stronger branching of Maximus ® hybrids and therefore the number of pods per plant; the plant requires no growth regulators or desiccant, plant maturing is uniform therefore no losses were registered, the speed and low costs of harvesting , the reduction of vegetable waste cultivation, represent the advantages of semi tall Maximus ® hybrids compared with conventional tall hybrids.

## CONCLUSIONS

The return of the rape seed on the European market thanks to its new uses, determined the resumption of work for improvement regarding the reintroduction of hybrids on the market. The research of the Pioneer Hi-Bred International Company allowed the launch of semi tall hybrids on the market.

The behavior of these hybrids on the Eastern European market, compared to conventional hybrids, was the basis for assessment and analysis of production capacity and oil content, typical for these two types of hybrids.

In the two years of analysis there has been observed both production differences and the ecological plasticity of the hybrids. Also, the numerous advantages of Maximus® semi tall hybrids are the basis of their performance. A significant difference is observed in the production capacity of the Maximus® hybrids reported at the average between the two hybrid types analyzed. There is also observed a negative difference for conventional hybrids related to controls. The difference of production is 8% for Maximus® hybrids, fact that proves a better

adaptation to the Eastern Europe climate condition.

The oil content is influenced by climatic conditions and presents insignificant amounts between the two types of hybrids analyzed.

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