

# MORPHO-PHYSIOLOGICAL AND PRODUCTIVITY ASPECTS OF SOME AUTUMN WHEAT VARIETIES (*TRITICUM AESTIVUM* L.) IN THE CLIMATE AND SOIL CONDITIONS OF ARAD AREA (ROMANIA)

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**Abstract:** This study considers the behavior of the principal varieties of autumn wheat, recommended by experts, in the temperature, humidity and soil conditions of Arad area, in order to find the most efficient solutions to expand this crop, considering that this plant represents an essential source of proteins and carbohydrates. Mono-factorial experiments were performed with 7 varieties of autumn wheat, in optimal technological conditions, in 4 repetitions. The experimental variants (V1 to V7) were composed of the following autumn wheat varieties: V1 – ‘Fundulea 4’; V2 – ‘Glosa’; V3 – ‘Flamura 85’; V4 – ‘Dropia’; V5 – ‘Apache’; V6 – ‘Lovrin 34’; V7 – ‘Libelula’. The evaluated characteristics are: plants height; weight of 1000 beans; hectoliter weight; number of wheat ears per m<sup>2</sup>; number of grains per wheat ear; grain and straw production; protein, gluten and fat content percentage in grains. Registered data recommends Arad area (Crișurilor Plain) area for successful cultivation of some autumn wheat varieties in optimal conditions.

**Keywords:** *Triticum aestivum*, morpho-physiology, productivity, wheat, Arad, Romania

## INTRODUCTION

Wheat (*Triticum aestivum* L.) is the most cultivated plant in the world, and for 8000 years it has been the basic food for the greatest civilizations of Europe, Western Asia and Northern Africa. Wheat (*Triticum aestivum* L.) is one of the most important cereal and the plant that occupies the largest surfaces on the Globe (240 mil. ha). China has the largest wheat cultivated area (29 mil. ha), closely followed by the United States (25 mil. ha), India (25 mil. ha), Russian Federation (24 mil. ha), Kazahstan (12 mil. ha) and Canada (11 mil. ha).

World production of wheat has reached the record of 592 million tons in 1990 and has remained relatively constant ever since. Western European countries hold the greatest wheat productions in the world, over 6 t/ha respectively. Holland holds the record of 8,6 t/ha, followed by The United Kingdom with an average of 7,5 t/ha.

Romania cultivates over 2 million ha each year, and had a 4 t/ha production in 2016. The biggest agricultural holdings in Romania that cultivate wheat and had a production worth over 6 tons/ha are: Great Brăila Island, Bărăgan Plain – in the south, Banat Plain – in the west etc.

Wheat grains have a high content of carbohydrates and protein substances. Wheat flour is the prime ingredient for bread and bakery products, representing the basic food for 35-40 % of world population.

Wheat is also used in industrial processing (alcohol, starch, dextrin, glucose) and as fodder. Brans are concentrated fodder, rich in proteins, carbohydrates and minerals. Straws are used in the cellulose industry and as food for animals.

Wheat has a special phyto-technical importance, being an excellent precursor for colza and autumn

fodder plants. It also creates the conditions for organic and mineral fertilizers administration and soil works.

## MATERIALS AND METHODS

The following materials were used to perform the experiments:

- alluvial soil with the following characteristics: pH = 7-7,5; Humus = 3,1-3,9%; Clay = 33-35%; Groundwater depth = 50 – 60 cm; Mobile Phosphorus = 13,44 mg/100 g soil; Total Nitrogen = 0,16 – 0,18 mg/100g soil;
- plot surface of 20 m<sup>2</sup>, L = 10 m, l = 2 m, protection space with 3 m width, a 2 m space between repetitions, and 0,5 m paths between variants;
- *Triticum aestivum* L. seeds of ‘Fundulea 4’, ‘Glosa’, ‘Flamura 85’, ‘Dropia’, ‘Apache’, ‘Lovrin 34’ and ‘Libelula’ varieties (Fig. 1, 2).

Soil works consisted in:

- autumn plowing at 25 cm depth, smoothed and kept free of weeds until sowing;
- in the autumn, before sowing, a disc harrow was applied and the germination bed was prepared with a combine at 4-5 cm depth;
- sowing was done in autumn, in the first decade of October, at 4-5 cm depth;
- for the entire vegetation period, the plots were kept free of weeds by specific care works.

Fertilization was done during the preparation on the germination bed, with complex NPK fertilizer: N = 100 kg/ha, P = 60 kg/ha and K = 90 kg/ha.

A mono-factorial experiment was performed with 7 varieties of autumn wheat in normal technological conditions, in 4 repetitions.



Fig. 1. Morphological aspect of wheat ear.



Fig. 2. *Triticum aestivum* L. caryopsis.



compared to the witness (89 cm), and of 11 cm and 10 cm respectively, compared to the Fundulea 4 variety,

for which the plant height didn't exceeded 84 cm (Table 1).

Tab. 1.

Influence of pedo-climatic conditions on autumn wheat plant's size.

No. crt.	Variety	Plant size (cm)	Difference (cm)
1	Fundulea 4'	84	-5
2	Glosa	95	6
3	Flamura 85	86	-3
4	Dropia	90	1
5	Apache	91	2
6	Lovrin 34	94	5
7	Libelula	88	-1
8	Witness (average)	89	0

Respecting the cultivation technology, and cultivating the appropriate varieties for Arad area, had a positive influence over the plant's growth and development, aspect that can be noticed in the seed production per surface unit. It is worth mentioning that

the smallest production was obtained for Fundulea 4 variety (5400 kg/ha), and the greatest production was obtained for Glosa variety (6800 kg/ha). Dropia and Apache also had important productions, of over 6 tons/ha (Table 2).

Tab. 2.

Influence of pedo-climatic conditions on seed production

No. crt.	Variety	Seed production (kg)	Difference (kg)
1	Fundulea 4	5400	-600
2	Glosa	6800	800
3	Flamura 85	5800	-200
4	Dropia	6200	200
5	Apache	6100	100
6	Lovrin 34	5900	-100
7	Libelula	5700	-300
8	Witness (average)	6000	0

The vegetative mass of plants was excellent, as it can be noticed in the production of straws per surface unit. The straws obtained after harvest had a weight

between 3300 kg/ha (Fundulea 4) and 4100 kg/ha (Glosa). The Glosa variety was noteworthy, with an addition of 500 kg/ha compared to witness (Tabelul 3).

Tab. 3.

Influence of pedo-climatic conditions on straw production

No. crt.	Variety	Straw production (kg)	Difference (kg)
1	'Fundulea 4'	3300	-300
2	Glosa	4100	500
3	Flamura 85	3500	-100
4	Dropia	3700	100
5	Apache	3600	0
6	Lovrin 34	3500	-100
7	Libelula	3400	-200
8	Witness (average)	3600	0

The Weight of 1000 beans (MMB) for the 7 varieties taken into study had average values between 40 g (Fundulea 4) and 45 g (Dropia). To be noticed that the Dropia variety has responded very well to the pedo-

climatic conditions, its Weight of 1000 beans exceeding that of the witness lot by 2 grams. On the opposite side, the Libelula variety had a weight of 1000 beans worth 41 g (Table 4).

Tab. 4.

Influence of pedo-climatic conditions on The Weight of 1000 beans (MMB)

No. crt.	Variety	MMB (g)	Difference (g)
1	Fundulea 4	40	-3



2	Glosa	43	0
3	Flamura 85	44	1
4	Dropia	45	2
5	Apache	42	-1
6	Lovrin 34	44	1
7	Libelula	41	-2
8	Witness (average)	43	0

The hectolitic mass, caring special importance for the grain grading and their ensilage, as well as for the correlation between this parameter and flour quality, had values between 75 kg (Apache and Lovrin 34) and

80 kg (Dropia). It's worth noticing that all varieties taken into study had a high hectolitic mass, which gives the wheat a great sale price (Table 5).

Tab. 5.

Influence of pedo-climatic conditions on the hectolitic mass (MH)

No. crt.	Variety	MH (kg)	Difference (kg)
1	Fundulea 4	77	0
2	Glosa	78	1
3	Flamura 85	79	2
4	Dropia	80	3
5	Apache	75	-2
6	Lovrin 34	75	-2
7	Libelula	76	-1
8	Witness (average)	77	0

Studies made on the seeds of these 7 varieties revealed a production of over 800 kg/ha vegetal proteins for the Glosa (884 kg/ha) and Dropia (806 kg/ha) varieties, in the climate and soil conditions of Arad. It's important to mention that Lovrin 34 variety

has produced 767 kg/ha proteins per surface unit. The smallest protein quantity was obtained for Fundulea 4 (594 kg/ha) and Libelula (684 kg/ha) varieties (Table 6).

Tab. 6.

Influence of pedo-climatic conditions on protein production

No. crt.	Variety	Proteins (kg/ha)	Difference (kg/ha)
1	Fundulea 4	594	-135
2	Glosa	884	155
3	Flamura 85	696	-33
4	Dropia	806	77
5	Apache	671	58
6	Lovrin 34	767	-38
7	Libelula	684	-45
8	Witness (average)	729	0

It is known that a high production lowers the protein quantity and quality of the grains, with repercussions on the bakery process. The bean proteins percentage was very good, especially for Lovrin 34, Dropia and Glosa varieties, having values between 11 – 13 % (Table 7).

The farmers are interested for their wheat production to contain as much gluten as possible. The reason is that gluten percentage is the most important indicator of wheat quality. For the varieties taken into study, we have noticed a good gluten content for the Lovrin 34 (27%), Apache (26%) and Gloria (26%) varieties (Table 8).

Tab. 7.

Influence of pedo-climatic conditions on protein percentage of beans

No. crt.	Variety	Proteins %	Difference (%)
1	Fundulea 4	11	-1
2	Glosa	13	1
3	Flamura 85	12	0
4	Dropia	13	1
5	Apache	11	-1

6	Lovrin 34	13	1
7	Libelula	12	0
8	Witness (average)	12	0

Tab. 8.

Influence of pedo-climatic conditions on gluten percentage of beans

No. crt.	Variety	Gluten %	Difference (%)
1	Fundulea 4	24	-1
2	Glosa	26	1
3	Flamura 85	25	0
4	Dropia	25	0
5	Apache	26	1
6	Lovrin 34	27	2
7	Libelula	24	-1
8	Witness (average)	25	0

In percentages, it can be noticed that for autumn wheat, the fat content, although insignificant, it was bigger for the variants cultivated with Libelula variety

(2%) and Fundulea 4 (2%). The smallest fat content was registered for wheat seeds of Dropin (1,5%) and Lovrin 34 (1,6%) varieties (Table 9).

Tab. 9.

Influence of pedo-climatic conditions on fat percentage of beans

No. crt.	Variety	Fats %	Difference (%)
1	Fundulea 4	2	0,2
2	Glosa	1,7	-0,1
3	Flamura 85	1,8	0
4	Dropia	1,5	-0,3
5	Apache	1,9	0,1
6	Lovrin 34	1,6	-0,2
7	Libelula	2	0,2
8	Witness (average)	1,8	0

Analyzing from an economic perspective the behavior of the 7 varieties of autumn wheat in the pedo-climatic conditions from Arad area, we can affirm that they were efficient, the profits were between 2955 lei/ha (Fundulea 4) and 4485 lei/ha (Glosa). Very good results were obtained for Dropia and Apache wheat varieties, where the profit exceeded

4000 lei/ha. Noteworthy was the behavior of Flamura 85 and Libelula varieties, for which we obtained an income smaller by 350 lei/ha and 515 lei/ha respectively, compared to the witness lot, reason for which they can be considered economically efficient as well (Table 10).

Tab. 10.

Influence of pedo-climatic conditions on economic efficiency

Variety	Seed production (kg/ha)	Production value (lei/ha)	Straw production (kg/ha)	Production value (lei/ha)	Production Total value (lei/ha)	Profit (lei/ha)	Difference (lei/ha)
Fundulea 4	5400	5130	3300	825	5955	2955	-945
Glosa	6800	6460	4100	1025	7485	4485	585
Flamura 85	5800	5510	3500	875	6385	3385	-515
Dropia	6200	5890	3700	925	7125	4175	275
Apache	6100	5795	3600	900	7000	4000	100
Lovrin 34	5900	5605	3500	875	6775	3775	-125
Libelula	5700	5415	3400	850	6550	3550	-350
Witness	6000	5700	3600	900	6900	3900	0

## CONCLUSIONS

The cultivation of the seven autumn wheat varieties in the climate and soil conditions from Arad permitted us to obtain some valuable morpho-physiological characteristics for all experimental variants.

High productions were obtained for all varieties, with an addition for Glosa variety, for which the seed quantity per surface unit was of 6800 kg/ha.

In the pedo-climatic conditions from Arad, with productions of over 6000 kg/ha, the Apache and Dropia varieties have proven to be a viable crop variant for this area.

The seed's high gluten percentage, makes the variants Lovrin 34 (27%), Glosa and Apache (26%) very valuable in bakery.

Protein (11-13%) and fat (1,5-2%) percentage was in between satisfactorily limits for all varieties taken into study.

From an economic perspective, the best results were obtained for Glosa variety, which provided an income of 7125 lei/ha and a profit worth 4175 lei/ha.

The most inefficient crop variants, with a profit of 2955 RON/ha and 3385 RON/ha, were Fundulea and Flamura 85 varieties, respectively.

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