Current Trends in Natural Sciences
Vol. 14, Issue 27, pp. 284-291, 2025
https://doi.org/10.47068/ctns.2025.v14i27.032

Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521

Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

INFLUENCE OF SOME BIO-FERTILIZERS ON THE MORPHOLOGY AND QUALITY OF WINTER WHEAT

Diana Maria POPESCU[1,*], Nicolae IONESCU [1], Cristina Mariana NICOLAE [1], Maria Magdalena PODEA [1]

[1]Agricultural Development Research Station Piteşti, Piteşti-Slatina road # 5, 117030, Piteşti, Romania

Current Trends in
Natural Sciences

Abstract
Research conducted in recent years has shown the need for a gradual reduction in NPK fertilizers. At the same time, the promotion of fertilizers characterized as being as gentle as possible on the growing environment has begun. This material presents results obtained with such fertilizers, namely for the cultivation of winter wheat, the products were specific: N-Durro 46 and Fertisfera 64 in different doses that can be applied in production farms. The results obtained have demonstrated particularly favorable levels, with some small differences in addition. Thus, the total production of biomass oscillated between 13-16 t/ha, the production of ears between 6.5-9.9 t/ha and the production of grains was between 5.7- 6.8 t/ha. An important index from a practical point of view was the mass- MTG of a thousand grains, which had values between 39 and 43 gr. Regarding the influence of the factors, positive correlations were generally found between the analyzed elements, which recommends the use of the 2 products in agricultural fields, especially on the soils specific to the station.

Keywords: biofertilizers   biomass, correlations, grains, winter wheat.

1. INTRODUCTION

In agriculture, plant growth elements and the use of fertilizers have undergone changes in recent times (Epstein & Bloom, 2005; Hawkesford, 2014). Thus, reductions have been observed in the classical technology of using chemical fertilizers (Ladha et all., 2005; Marschner, 2012). For winter wheat, classical conditions are currently provided for the use of macroelements and NPK at an average level of N100 P80 K40 (Barraclought, et all., 2010; Erenstein et all., 2022). From soil and plant analyses (Nataraja et all., 2006); Prey et all., 2019) it was found that this level must be adapted with climate change (Mandal at all., 2007). Given the occurrence of the drought period in wheat, these fertilization levels are no longer necessary. The explanation is that wheat plants can no longer assimilate those levels of fertilizers, as a result of which NPK doses are reduced and even replaced with complex fertilizers that harmonize macroelements with microelements (Ronen, 2007; Miner et al., 2022). Usually, there is also an improvement in fertilizers through an addition of organic matter (Ova et all., 2015). This reduction in fertilizer quantities also provides better protection for the growing environment (Mandal at all., 2007). This material presents complex aspects regarding the use of new products (Silva at all., 2017; Wallace at all., 2020) that meet current, new requirements. In addition to these aspects, it has also been found that the industry in the field has begun to

*Corresponding author, E-mail address: deea_zuzu@yahoo.com

Current Trends in Natural Sciences
Vol. 14, Issue 27, pp. 284-291, 2025
https://doi.org/10.47068/ctns.2025.v14i27.032
Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521
Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

reprofile itself more and more (Khan at all., 2012; Hawkesford, 2017). The two new products tested in wheat cultivation (Malakouti, 2008) also contain some fertilizers based on plant absorption inhibitors (Silva at all., 2017; Walace at all., 2020). From the point of view of the morphological expression of wheat plants, the results obtained in our country and elsewhere have demonstrated moderate values, but with some increase in quality (Ladha at all., 2005).

2. MATERIALS AND METHODS

In the winter wheat culture, an experiment was set up with two factors, namely: factor A the type of fertilizer and factor B the doses used. Winter wheat was cultivated according to the specific technology to the station. From the point of view of vegetation, wheat sown on October 24, tillering on November 9, twinning occurred on February 8, flowering took place on May 7 and maturity occurred on June 15. The following were used in the experiment: N-Durro 46 which contains total N (N 45.7% and potassium oxide below 1%, nitrogen is represented by urea treated with nitrification inhibitors and humic extracts. The second product Fertisfera 64 is an NP type fertilizer treated with humic substance inhibitors. The chemical content is as follows: total N 17.9%, P_2O_5 45.9%, S 1.5%, K_2O 0.55%, CaO 0.34%, Fe 0.26%, Ba 0.021%, Cr 0.12%, Cu 0.003%, Zn 0.027%. The phosphorus in Fertisfera 64 was quickly utilized by the plants. The experiment was carried out according to the block method in 3 repetitions. The surface of the variants was 50 m² (5x10m). Application the fertilizers were applied in the autumn period after wheat sowing. The following determinations were made: plant biomass expressed in: total production, ear production, grain production and thousand grain mass (TGM). Quality determinations were performed on wheat grains on common indices such as: crude protein (CP), starch content, wet gluten content and Zeleny index. Statistical data processing was performed using the variance analysis method for some of the production indices.

3. RESULTS AND DISCUSSIONS

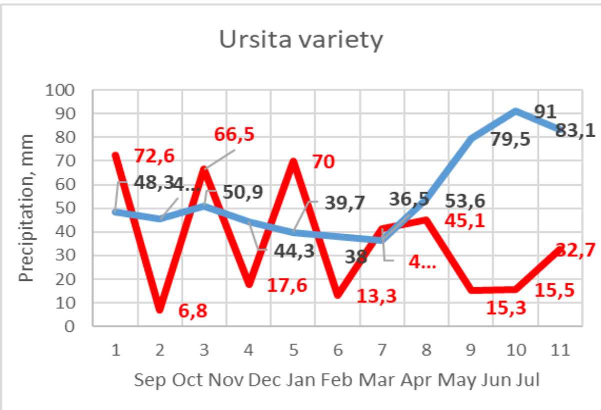

Figure 1. Precipitation regime in wheat crop

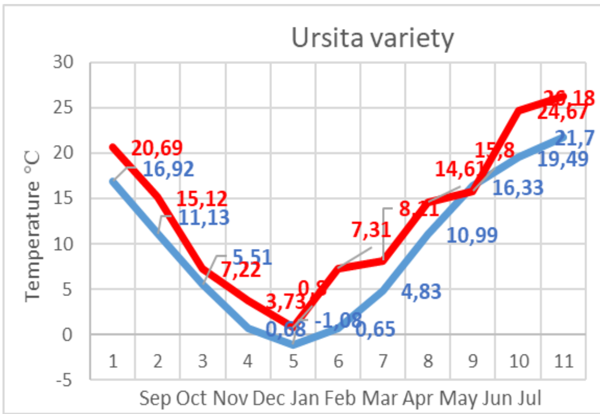

Figure 2. Thermal regime in wheat vegetation

The winter wheat crop was very obviously influenced by both the precipitation regime and the temperature regime. As regards precipitation (fig.1), the entire climatic background was within deficient limits. For this reason, there were periods of drought against the background of somewhat higher thermal values. At the same time, it was found that for the autumn period the level of rainfall was above normal, namely in the months of September, November and January. Under these

http://www.natsci.upit.ro
*Corresponding author, E-mail address: deea_zuzu@yahoo.com

Current Trends in Natural Sciences
Vol. 14, Issue 27, pp. 284-291, 2025
https://doi.org/10.47068/ctns.2025.v14i27.032
Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521
Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

conditions, the wheat sown on time sprouted and tilled under relatively normal conditions. At the same time, the favorable situation created led to a significant accumulation of water in the soil (fig.2). In February and March, the level of water supply was within normal limits, and starting from May until maturity, respectively the period after flowering and grain deposition, a very large lack of water was observed. Of course, wheat plants were negatively influenced, but not to the same extent that they did not form productions of 5-6 t/ha grains. Regarding the thermal regime in wheat cultivation, the 2023-2024 agricultural year is considered very warm. Thus, in the autumn period, the average monthly temperatures were higher by 2-3 °C, in the spring months this high temperature level was maintained, which forced the growth of plants in the early phenophases. In May, when wheat flowering took place, the only monthly temperature regime below the multiannual average was recorded. In the period after flowering and maturity, when plants need moderate temperatures, values about 3°C higher than the annual ones were recorded. Considering the climate of this agricultural year, it can be said that some autumn precipitation was favorable for wheat, which is why the wheat managed to grow almost normally and utilize the fertilizers from the experiments carried out.

Table 1. Influence of doses of new ecological fertilizers on wheat morpholgy

Fertilizers	Doses, Kg/ha	Total biomass		Ear biomass		Grain biomass		TGV,g	%
		t/ha	%	t/ha	%	t/ha	%		
N-Durro 46	200	16.1	100.0	9.9	61.5	6.8	42.2	40.57	100.0
	400	15.5	100.0	9.2	57.1	6.4	39.7	41.50	102.0
	600	14.3	100.0	9.1	56.5	6.5	40.4	38.53	95.0
	800	13.1	100.0	7.8	48.4	5.2	32.3	40.10	99.0
Fertisfera 64	200	10.9	100.0	6.5	40.4	4.3	26.7	38.80	96.0
	400	13.4	100.0	7.9	49.0	5.7	35.4	40.50	100.0
	600	14.1	100.0	9.2	57.1	6.5	40.4	42.80	105.0
	800	14.2	100.0	9.1	56.5	6.4	39.7	41.23	101.0
Average		13.9	100.0	8.6	53.3	5.9	37.1	40.5	99.7
LSD5%		*4.32*		*2.24*		*2.29*		*6.39*	*15.8*
LSD1%		*7.64*		*5.16*		*4.16*		*12.53*	*30.9*
LSD0,1%		*17.89*		*16.43*		*10.16*		*33.78*	*83.3*

The total biomass obtained (table 1) ranged between 13 and 16 t/ha total quantities, the fertilizers used had an influence, either within the error limits or slightly increasing, depending on the doses applied. The wheat ears obtained in the variants constituted between 7.8-9.9 t/ha which meant an average proportion of 53% by total. The grains obtained oscillated between 5.2-6.8 t/ha, representing 37% of the total biomass. From a qualitative point of view, the TGV was between 39 and 43 gr, without significant differences.

Table 2. Influence of fertlizer type on wheat total biomass

Fertilizers	t/ha	%	Doses	t/ha	%
N-Durro	14.7	100.0	200	13.5	100.0
Fertisfera	13.1	89.2	400	14.5	106.9
LSD5%	3.4	*23.1*	600	14.2	104.8
LSD1%	7.9	*53.7*	800	13.6	100.7
LSD0,1%	25.3	*172.1*	*LSD5%*	*2.45*	*18.1*
			LSD1%	*3.43*	*25.4*
			LSD0,1%	*4.85*	*35.9*

*Corresponding author, E-mail address: deea_zuzu@yahoo.com

Current Trends in Natural Sciences
Vol. 14, Issue 27, pp. 284-291, 2025
https://doi.org/10.47068/ctns.2025.v14i27.032
Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521
Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

Factor A (table 2), namely the type of fertilizer, demonstrated that the N-Durro product formed more total biomass, namely 14.7 t/ha. In terms of significance, no differences were found.

Table 3. Influence of fertilizer doses on ears biomass

Fertilizers	t/ha	%	Doses	t/ha	%
N-Durro	9.0	100.0	200	8.2	100.0
Fertisfera	8.18	90.4	400	8.6	104.5
LSD 5%	*2.24*	*24.8*	600	9.2	112.0
LSD 1%	*5.16*	*57.3*	800	8.5	103.5
LSD0,1%	*16.43*	*182.5*	*LSD 5%*	*1.81*	*22.1*
			LSD 1%	*2.55*	*31.1*
			LSD0,1%	*3.60*	*43.9*

The statement also holds true for the formation of ear biomass, where the same fertilizer produced an average of 9 t/ha (table 3). The other fertilizer was about a 1.0 t/ha below the first fertilizer. There were no differences between the two formulations.

Table 4. Influence of fertilizer type production dosese on grain biomass

Fertilizers	t/ha	%	Doses	t/ha	%
N-Durro	6.3	100.0	200	5.6	100.0
Fertisfera	5.7	91.9	400	6.1	108.0
LSD 5%	*1.91*	*30.3*	600	6.5	116.4
LSD 1%	*4.42*	*70.1*	800	5.8	103.9
LSD 0,1%	*14.06*	*223.2*	*LSD5%*	*1.21*	*21.6*
			LSD1%	*1.69*	*30.2*
			LSD0,1%	*2.39*	*42.7*

The average level of grain production (table 4) showed good yields, namely 6.3 t/ha in the case of the first fertilizer and 5.7 t/ha in the case of the second fertilizer, with no significant differences between the products.
Regarding the dispersion analysis of the experimental factors (table 5) positive effects (F test) were found in general. In one direction, significant differences were obtained, namely only in the case of the interaction between the two varieties regarding grain production. Although the experimental factors, through their properties, did not obviously induce significant positive aspects, on the contrary, positive influences were demonstrated in the case of grain formation.

Table 5. Analysis of variance of experimental factors

The cause of variability	SP			GL	s^2 (variant)			F test			
	Total.s.u	Ear	Grains		T.su	Ear	Grains				
R	19.81	9.6	4.55	2							
A	15.20	4.5	1.55	1	15.20	4.5	1.55	3.94	2.8	1.31	18.51(98.50 998.52)
Ea	7.71	3.2	2.37	2	3.86	1.6	1.18				
P.large	42.72	17.3	8.47	5							
AxB	33.26	18.4	10.12	3	11.05	6.13	3.37	2.93	3.02	3.70*	3.49 (5.95; 10.80)
B	3.57	3.0	2.77	3	1.19	1.0	0.92	0.31	0.50	1.01	9.28 (29.46 148.50)
Eb	45.34	24.9	11.0	12	3.77	2.0	0.91				
P.small	82.07	46.3	23.89	18							
T.Exp	124.79	63.6	32.36	23							

*Corresponding author, E-mail address: deea_zuzu@yahoo.com

Current Trends in Natural Sciences
Vol. 14, Issue 27, pp. 284-291, 2025
https://doi.org/10.47068/ctns.2025.v14i27.032
Current Trends in Natural Sciences (on-line) Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-953X ISSN: 2284-9521
ISSN-L: 2284-9521 ISSN-L: 2284-9521

Table 6. Influence of bio- fertilizer doses on wheat quality indices

Fertilizers	Doses	Crude protein (CP)%	Starch %	Wet gluten %	Zeleny index ml
N-Durro 46	200	9.80	70.56	18.13	22.07
	400	11.90	70.17	19.47	26.17
	600	11.90	72.97	20.33	26.97
	800	11.40	69.33	20.87	31.83
Fertisfera 64	200	10.13	70.43	18.33	25.43
	400	12.33	69.60	17.97	22.77
	600	12.50	70.13	21.23	32.83
	800	11.97	70.07	20.47	29.90
Average		11.5	70.4	19.6	27.2
LSD 5%		*3.07*	*3.22*	*6.29*	*23.34*
LSD 1%		*5.05*	*5.22*	*11.71*	*45.12*
LSD 0,1%		*10.44*	*10.53*	*29.59*	*119.50*

From the point of view of the quality of the wheat grains (table 6), slight differences were found, but their level is considered favorable and very favorable. Thus, CP had slightly low values at low doses of fertilizers, and as they increased, values over 11% were obtained at N-Durro and over 12% at Fertisfera. The qualitative level of over 12% CP is considered very good and that between 11-12% as a good level. Starch ranged between 69-72% being insignificant between the variants. Wet gluten, which represents a quality element of bread formation, was between 18-21%. From this point of view of this parameter, the wheat grains obtained show favorable quality. The Zeleny index also expressed high values between 23 and 33%, from this point of view, the flour intended for bread manufacturing will demonstrate an additional quality.
At the level of all the correlations obtained, the links between all the morphological parameters (table 7) studied were significantly and positively highlighted, as well as at the level of the CP and wet gluten link, as well as the links between the Zeleny index and wet gluten. Among these, the links between the CP, wet gluten and Zeleny index showed the same positive phenomena.

Table 7. Correlations between wheat morphological characters and quality

	Total biomass	Ear biomass	Grain biomass	Crude protein	Starch %	Wet gluten %	Zeleny Index, ml
Total biomass	1	**0.955**	**0.901**	-0.001	0.262	0.119	0.359
Ear biomass		1	**0.964**	0.033	0.286	0.050	0.085
Grain biomass			1	0.086	0.363	0.124	0.352
Crude protein				1	0.005	0.631	0.222
Starch					1	0.161	0.553
Wet gluten						1	**0.792**
Zeleny index							1
LSD5% = 0.65		LSD1% = 0.76			LSD0,1% = 0.88		

*Corresponding author, E-mail address: deea_zuzu@yahoo.com

Current Trends in Natural Sciences
Vol. 14, Issue 27, pp. 284-291, 2025
https://doi.org/10.47068/ctns.2025.v14i27.032
Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521
Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

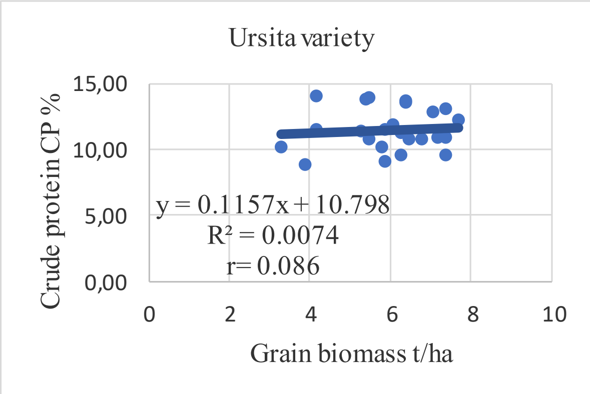

Figure 3. Correlation between grain biomass and crude protein

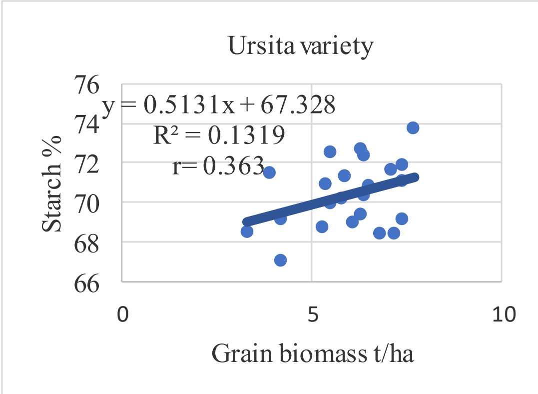

Figure 4. Correlation between grain biomass and starch

Given the relatively sensitive differentiations between morphological and quality indices of wheat, it was considered necessary to observe some correlations in detail. Figure 3 shows a relatively weak link between CP and total wheat biomass. At the same time, the link between starch and total biomass was relatively positive, with a determination coefficient of 13%.

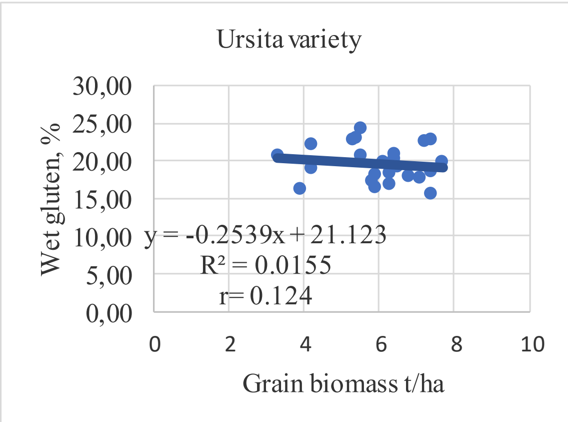

Figure 5. Correlation between grain biomass and wet gluten

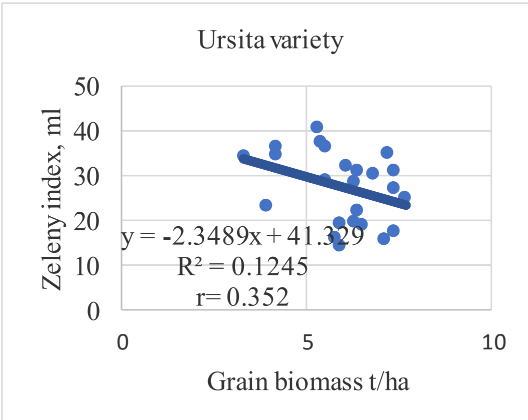

Figure 6. Correlation between grain biomass and Zeleny

Wet gluten with valences close to protein, demonstrated a weak negative correlation and namely about 2% determination (Figure 5). The Zeleny index demonstrated the obviously significant correlation with a determination of 12%. (Figure 6).

*Corresponding author, E-mail address: deea_zuzu@yahoo.com

Current Trends in Natural Sciences
Vol. 14, Issue 27, pp. 284-291, 2025
https://doi.org/10.47068/ctns.2025.v14i27.032
Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521
Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

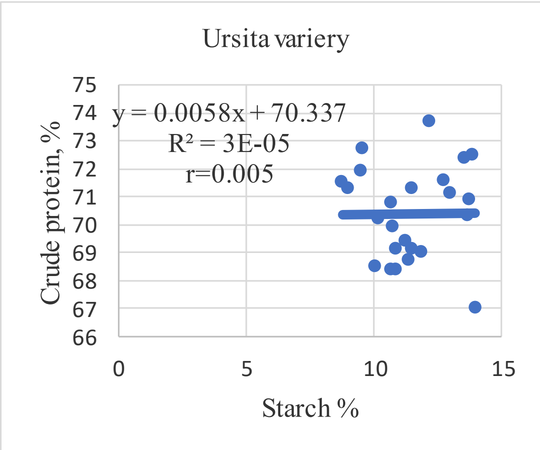

Figure 7. Correlation between crude protein and starch

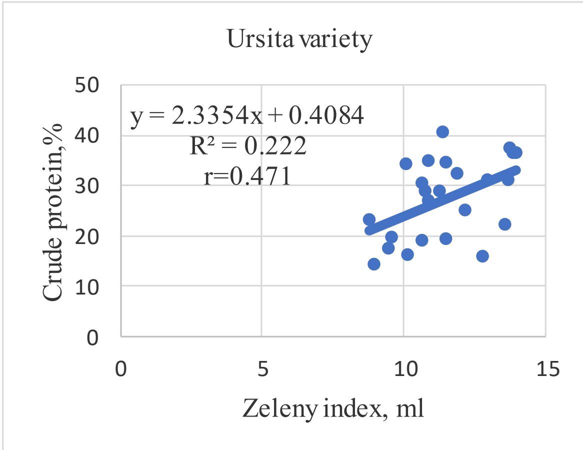

Figure 8. Correlation between crude protein and Zeleny

Among the quality elements determined in wheat grains, both positive and negative situations were found, thus between PB and starch the correlation was extremely weak, which can practically demonstrate the non-existence between them. The correlation between the Zeleny index and crude protein was somewhat more obvious, which indicates a better collaboration between the 2 elements in the formation of quality bread.

4. CONCLUSIONS

1. Current agronomic requirements require that the most gentle macro-microelement ingredients be used when fertilizing, so in this situation 2 new products were used: N-Durro and Fertisfera.
2. The total biomass level was around 15-16 t/ha this year, with no more differeces. The morphological components, namely the spikes, represented over 50% of the total and the grains approached and even exceeded 40% of the total. With these results, the TGV values were above 40 gr, which could have had positive influences on the quality of the grains.
3. A positive influence was obtained in the case of the morphology of the 2 fertilizers, namely the interaction between the factors, at the grain level.
4. Also, wheat grains were recorded with values between 11-12% CP, this being favored by an increase in fertilizer doses. Starch was recorded at around 70%, and gluten content exceeded 20%. Zeleny index had values close to 30-33 ml, explaining that the flour has a superior quality.
5. The correlation between the studied elements showed increases between starch and grain biomass, as well as between Zeleny and CP indices. At the same time, negative correlations were observed in all the links between grain production, wet gluten and Zeleny index.

5. REFERENCES

Barraclough, P.B., Howarth, J.R., Jones, J., Lopez-Bellido, R., Parmar, S., Shepherd, C.E., Hawkesford, M.J. (2010). Nitrogen efficiency of wheat: Genotypic and environmental variation and prospects for improvement. *European Journal of Agronomy*, *33*, 1–11.

Epstein, E., Bloom, A.J. (2005). Mineral Nutrition of Plants: Principles and Perspectives, 5th ed.; *Sinauer Associates, Inc.*: Sunderland, MA, USA.

Erenstein, O., Jaleta, M., Mottaleb, K.A., Sonder, K., Donovan, J., Braun, H.J. (2022). Global trends in wheat production, consumption and trade. In *Wheat Improvement*; Reynolds, M.P., Braun, H.J., Eds.; Springer: Cham, Switzerland.

*Corresponding author, E-mail address: deea_zuzu@yahoo.com

Current Trends in Natural Sciences
Vol. 14, Issue 27, pp. 284-291, 2025
https://doi.org/10.47068/ctns.2025.v14i27.032
Current Trends in Natural Sciences (on-line) Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-953X ISSN: 2284-9521
ISSN-L: 2284-9521 ISSN-L: 2284-9521

Hawkesford, M.J. (2014). Reducing the reliance on nitrogen fertilizer for wheat production. *Journal of Cereal Science*, *59*, 276–283.

Hawkesford, M.J. (2017). Genetic Variation in Traits for Nitrogen Use Efficiency in Wheat. *Journal of Experimental Botany*, *68*, 2627–2632.

Khan, M.K., Pandey, A., Hamurcu, M., Gezgin, S., Athar, T., Rajput, V.D., Gupta, O.P., Minkina, T. (2012). Insight into the Prospects for Nanotechnology in Wheat Biofortification. *Biology, 10,* 1123.

Ladha, J.K., Pathak, H., Krupnik, T.J., Six, J., van Kessel, C. (2005). Efficiency of fertilizer nitrogen in cereal production: Retrospects and prospects. *Advances in Agronomy, 87*, 85–156.

Malakouti, M.J. (2008). The effect of micronutrients in ensuring efficient use of macro-nutrients. *Turkish Journal for Agriculture and Forestry*, *32*, 215–220.

Mandal, A., Patra, A.K., Singh, D., Swarup, A., Masto, R.E. (2007). Effect of long-term application of manure and fertilizer on biological and biochemical activities in soil during crop development stages. *Bioresources Technology, 98*, 3585–3592.

Marschner, H., Marschner, P. (2012). *Mineral Nutrition of Higher Plants*, 3rd ed.; Elsevier/Academic Press: London, UK, 2012.

Miner, G.L., Delgado, J.A., Ippolito, J.A., Johnson, J.J., Kluth, D.L., Stewart, C.E. (2022). Wheat grain micronutrients and relationships with yield and protein in the U.S. Central Great Plains. *Field Crops Research*, 279.

Nataraja, T.H., Halepyati, A.S., Pujari, B.T., Desai, B.K. (2006). Influence of phosphorus levels and micronutrients on the physiological parameters of wheat. *Karnataka Journal of Agriculture Science*, *19*, 685–687.

Ova, E.A., Kutman, U.B., Ozturk, L., Cakmak, I. (2015). High phosphorus supply reduced zinc concentration of wheat in native soil but not in autoclaved soil or nutrient solution. *Plant Soil, 393*, 147–162.

Prey, L., Kipp, S., Hu, Y., Schmidhalter, U. (2019). Nitrogen use efficiency and carbon traits of high-yielding European hybrid vs. line winter wheat cultivars: Potentials and limitations. *Frontiers of Plant Science*, *9*, 1–15.

Ronen, E. (2007). Micro-elements in agriculture. *Practical Hydroponics Greenhousses, 164*, 39–48.

Silva, A.G.B., Sequeira, C.H., Sermarini, R.A., Otto, R. (2017). Urease inhibitor NBPT on ammonia volatilisation and crop productivity: A meta-analysis. *Agronomy Journal, 109*, 1–13.

Wallace, A.J., Armstrong, R.D., Grace, P.R., Scheer, C., Partington, D.L. (2020). Nitrogen use efficiency of 15N urea applied to wheat based on fertiliser timing and use of inhibitors. *Nutrient Cycling Agroecosystems, 116*, 41–56.

*Corresponding author, E-mail address: deea_zuzu@yahoo.com